

The **MINING CONGRESS JOURNAL**

Volume 13

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No. 8

IN THIS ISSUE

**A Symposium on National Problems
Railroad Consolidation
Taxation of American Business in Europe
Shall the National Forests be Abolished
Western Division Meeting**

**Mine Drill Equipment
Lead and Zinc in Arizona**

**Reports of the Mechanization Survey
Stream Pollution Through Mine Drainage**

Contributors:

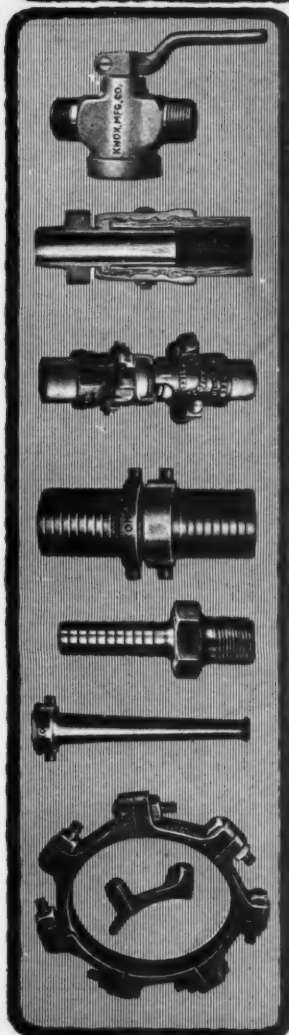
*Mitchell B. Carroll, William B. Greeley, Howard N. Eavenson,
W. B. Gehring, G. E. Harding, G. B. Southward.*

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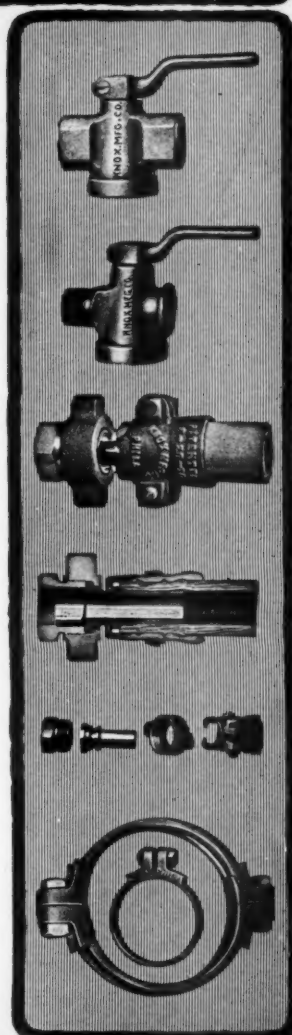


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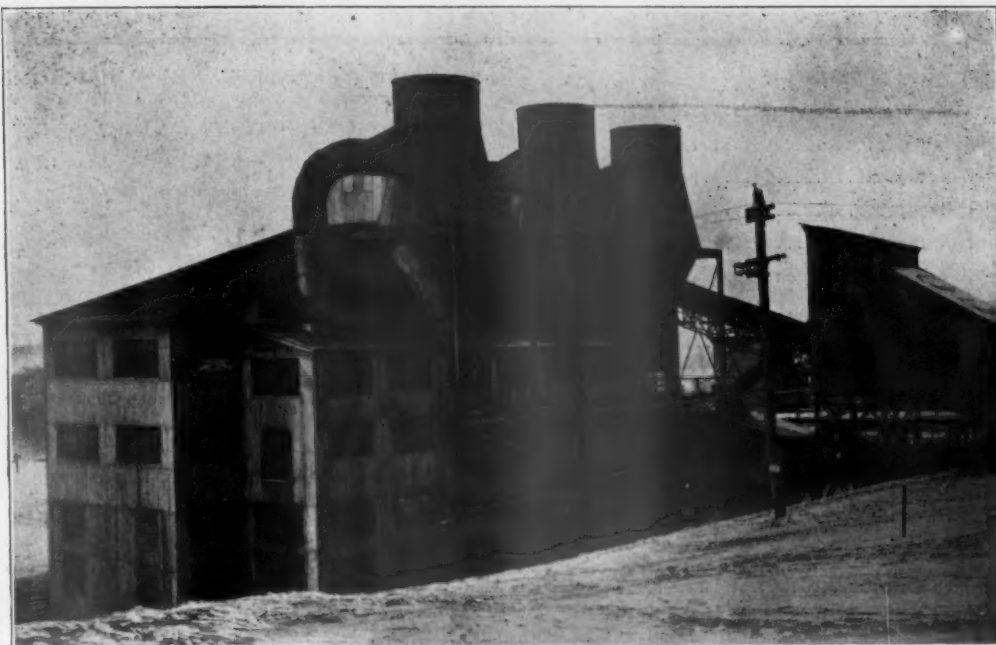


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Remarkable results are being obtained at this plant in Sulphur and Ash Reduction. Visit this plant and obtain first-hand information yourself or inquire of the coal company.

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THE MINING CONGRESS JOURNAL

AUGUST, 1927

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PRACTICAL OPERATING MEN'S DEPARTMENT

COAL

Stream Pollution Through Mine Drainage

METALS

Lead and Zinc in Arizona

Selection, Care, Use and Standardization of Mine Drill Equipment

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Working One Face Instead of Fifteen

If you can cut one hundred and fifty tons of coal a day from one face, you can work one face instead of fifteen.

Many mines today concentrate on a few faces, saving much of the overhead cost of track laying, wiring, ventilating, inspection and maintenance that is met in ordinary distributed room mining.

A Jeffrey Longwall Cutting

Machine and the Jeffrey Sectional Conveyor will advance fast enough to make this "concentrated mining" practical. This conveyor can take eight tons of coal from the face every five minutes and load it onto entry cars three hundred feet away.

The following pages show how strongly the Jeffrey Sectional Conveyor is made and how easily it is set up.

50 YEARS OF SERVICE TO INDUSTRY

JEFFREY
COAL MINE EQUIPMENT

Jeffrey-Standard
Coal Mine
Equipment
Coal Cutters
Combination Cutter
and Loader
Drills
Conveyor-Loader
Sectional Conveyor
Flat Car Loaders
Locomotives
Mine Fans
Tipple Equipment
Crushers

Two Men Easily Set Up T

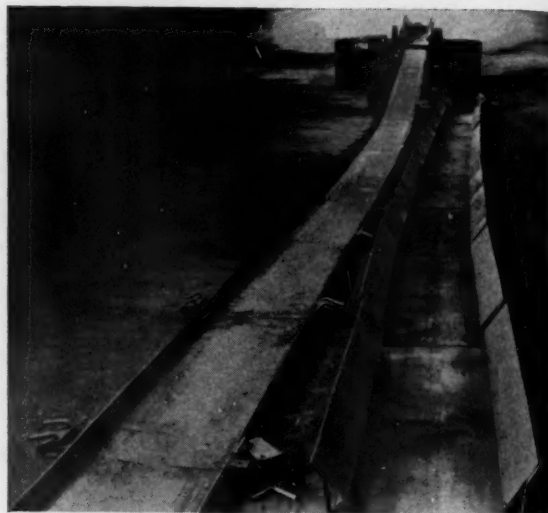


Truck Carries Top Pans

When the whole length of the conveyor is laid at once the bottom pans are first put down one by one for about a hundred feet. These make a track for a special truck that is used to bring up the rest of the bottom and top pans as fast as they can be laid.

This saves the labor of carrying the pans from the entry and is possible only with the Jeffrey as the top and bottom pans are separate units.

The top pans taken off the truck are laid beside the bottom pans until the return strand of chain is laid.



Lifts Coal Into Cars

To load coal into entry cars, the head end of the conveyor is shored up by piled timbers or supported on a strut of structural iron, bringing the coal over the tops of the cars.

This allows a whole trip of cars to be loaded without uncoupling, keeping two locomotives busy, one bringing the trip of empties and the other taking the loaded trip to the tippie.

The Jeffrey Sectional Conveyor will work on a steep slope. This is possible only with a positive carrying conveyor. Consequently only a few feet of shoring at the head end is needed.

The renewable guides on the upper pan that hold down the ends of the flight keep the chain in the pan on any slope.

The Jeffrey Manufacturing Company

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Philadelphia

Scranton, Pa.
Pittsburgh

Chicago
Charleston, W. Va.

Salt Lake City
Denver

Birmingham
Montreal, Canada

JEFFREY

This Sectional Conveyor



Chain Is Laid In Pans

After the head end is set up no more chain threading is necessary.

The return strand is taken in convenient sections from an entry car and pulled along the bottom pans. Two men do this without effort.

Then the top pans that were brought up on the truck are clevised in place and the top strand of chain is laid down and the end coupled to the end of the return strand.

The chain is built like a coal cutter chain with interlocking lugs on the side bars that take all the pull. The rivets serve merely to hold the links together.

Renewable and reversible guides take the wear on the sides of the pan and hold the chain in the pan.



Sections Easily Added

As most undercutting machines working in rooms advance six feet at a cut, the chain and pan sections are only six feet long and are light enough to be easily carried by two men. Clamping the sections together with clevises allows the conveyor to be readily assembled.

Because the top and bottom pans are separate and the clevis pins tapered, the conveyor can be laid over rolly bottom or horsebacks. No anchors or jacks are needed.

The chain sections are merely laid on the pans instead of being threaded through them as in other chain conveyors.

At six feet intervals the chain is assembled with bolts instead of rivets and can be disconnected as often as new sections are added. One entire six-foot section is made of bolted links so that the chain tension can be readily adjusted.

The Jeffrey Sectional Conveyor carries a full load up to three hundred feet.

958-99 North Fourth St., Columbus, Ohio

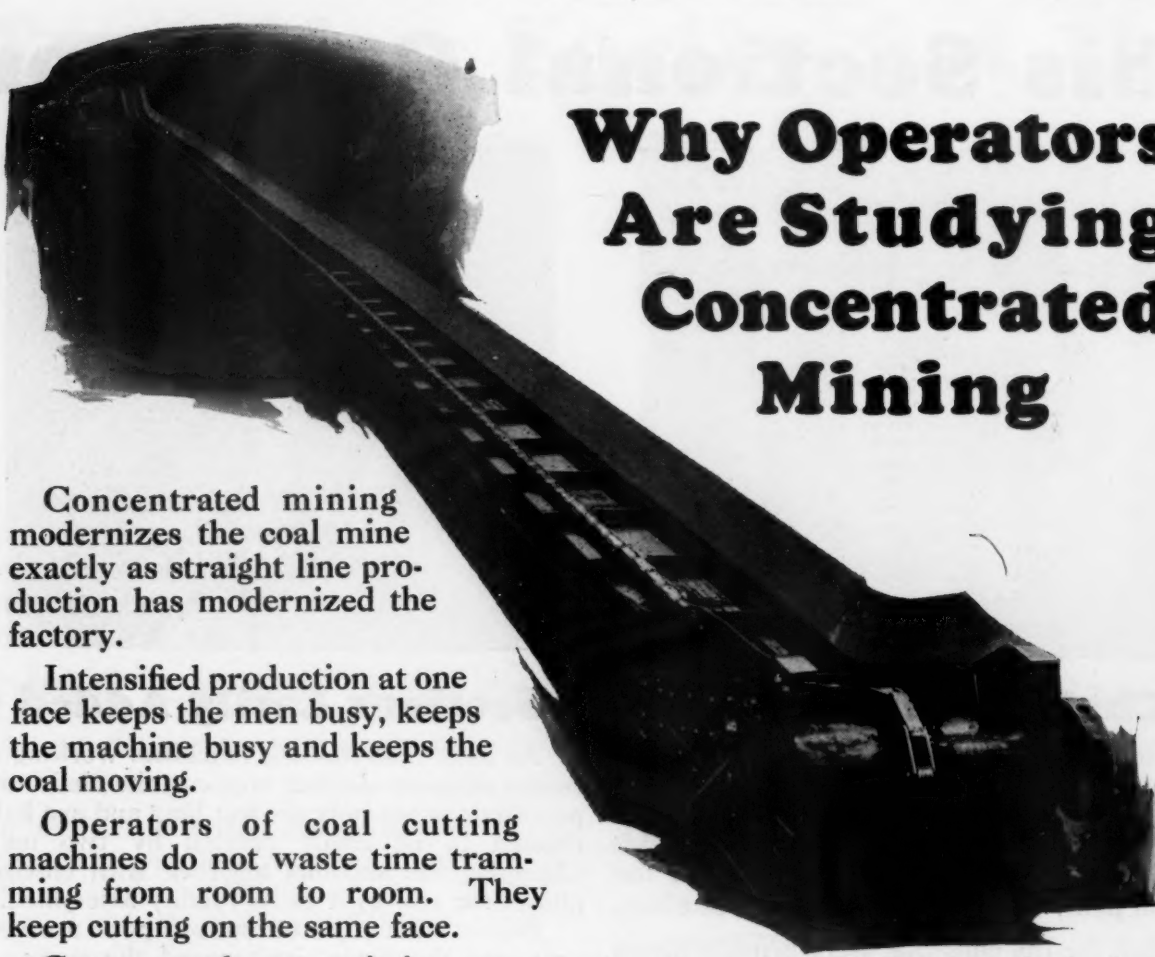
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Terre Haute, Ind., 319 Cherry St.
Scranton, 122 Adams Ave.

Coal Mine EQUIPMENT



Why Operators Are Studying Concentrated Mining

Concentrated mining modernizes the coal mine exactly as straight line production has modernized the factory.

Intensified production at one face keeps the men busy, keeps the machine busy and keeps the coal moving.

Operators of coal cutting machines do not waste time tramming from room to room. They keep cutting on the same face.

Conveyors do not wait for cars to come from the entry, for the coal goes to the cars instead. The Jeffrey Sectional Conveyor fills a whole trip of cars on the entry at once.

A section foreman supervises the work more directly and consequently the work advances steadily.

Operating expenses are cut down further by shorter airways, fewer

brattices, less wiring, track laying and timbering.

Accidents are fewer, too. The fire boss has less ground to cover and the face boss is always on the spot where the men are working. This closer supervision keeps the accident record low.

Jeffrey builds the equipment for the modernized mine.

The Jeffrey Mfg. Co., 958-99 North Fourth St., Columbus, Ohio

New York Philadelphia Scranton, Pa. Pittsburgh Chicago Charleston, W. Va. Salt Lake City Denver Montreal, Canada Birmingham
 Sales and Service Stations Salt Lake City, 153 W. 2d South St. Pittsburgh, 200 2d Ave. Terre Haute, Ind., 319 Cherry St.
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50 YEARS OF SERVICE TO INDUSTRY

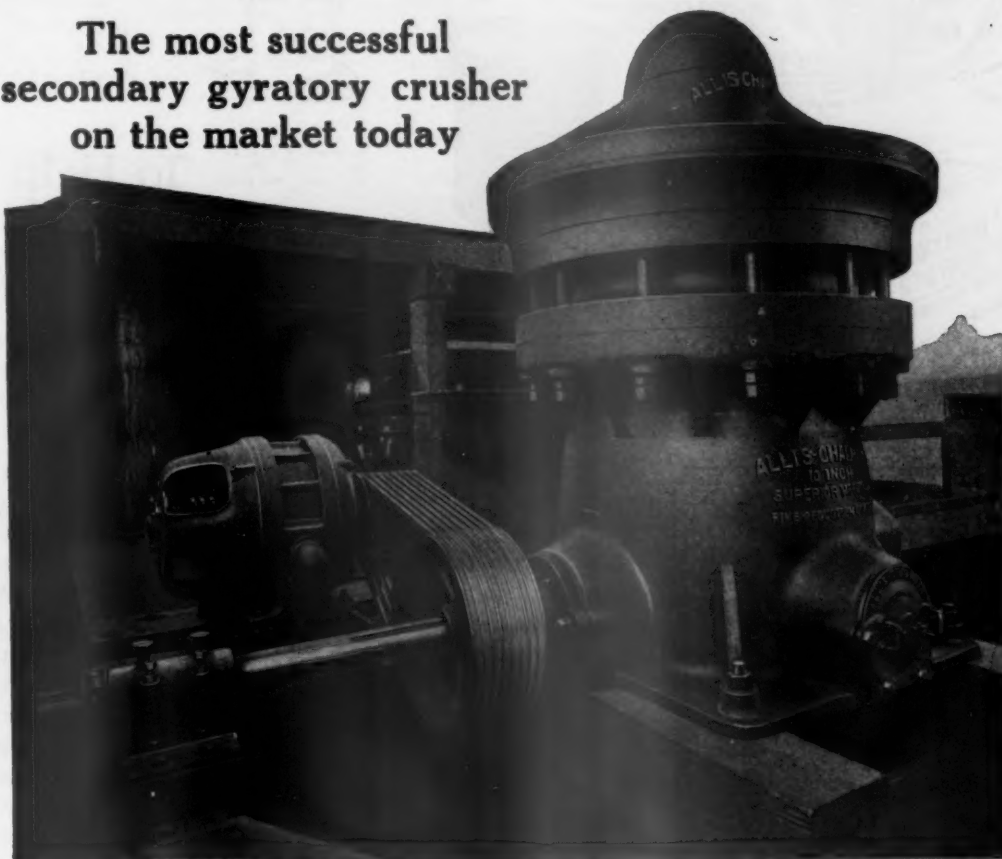
JEFFREY
COAL MINE EQUIPMENT

**Jeffrey-Standard
 Coal Mine
 Equipment**

Coal Cutters
 Combination Cutter
 and Loader
 Drills
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 Mine Fans
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 Crushers

Superior McCully Fine Reduction Gyratory Crusher

The most successful
secondary gyratory crusher
on the market today



10-Inch Superior McCully Fine Reduction Crusher driven through Texrope Drive from 75 H. P. Type "ARY" Motor. Crusher, motor and drive are all of Allis-Chalmers manufacture

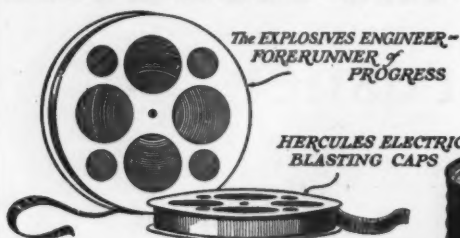
SIZES, CAPACITIES, HORSE POWER AND WEIGHTS

Size of Crusher in Inches	Two Feed Openings, Size Each in Inches	Capacity Per Hour in Tons of 2,000 Pounds												Driving Pulley		H.P. Required	Weight of Crusher in Pounds
		Size of Discharge Opening in Inches												Size in Inches	R.P.M.		
		¾	7⁄8	1	1¼	1½	1¾	2	2¼	2½	3	3½	4				
6	6x40	24	28	32	40	48								36x12½	500	40 50	32,000
10	10x52					80	94	107	120	135				36x19	450	75 100	64,000
18	18x68									250	300	350	400	44x25	400	150 200	182,000

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Educational Motion Pictures at Your Service



Hercules Specials Nos. 1, 2, 3 are among the most important of the improved Hercules explosives. They have effected savings as high as 30%.



Herco - Blasting Powder, used in Hercoblasting, the blasting method consisting of firing black powder column-loaded in well drill holes, with Cordeau-Bickford.



The galvanometer is a valuable instrument for testing electric blasting caps and circuits.



Hercules Blasting Caps are made in two sizes, No. 6 and No. 8, No. 8 having twice the explosive charge of No. 6.

To Help You the Right

THE Hercules Powder Company tries to make explosives exactly suited to every purpose in metal mining, quarrying, and construction, and to provide customers with the most advanced and practical information on the use of its products.

Recently, the need has been evident for a higher ammonia content powder than the well-known Extra, L.F., series. The result is Herculite-Nos. 1, 2, and 4. These new powders have now been used successfully in the field under experimental conditions, and are ready for general introduction. The Herculites are made on the same principle as the Hercules Specials. Although their cartridge counts do not run as high as those of the Specials, they have proportionately more explosive value per dollar than the Extra, L.F., grades. Perhaps you can use one of these Herculites on your work and save money. The nearest Hercules office will gladly supply full information about them and tell you whether or not they would meet your requirements at a saving.

Foremost among other improved Hercules explosives are the Specials Nos. 1 and 2 which have been highly successful and economical for open-pit mining and quarrying; Special No. 3 was developed in response to many requests for a powder that would offer the same marked advantages for underground work on which it is proving very successful in many places. Herco Blasting Powder is a special black blasting powder for Hercoblasting, which consists of shooting blasting powder column-loaded with Cordeau-Bickford in well-drill holes. Where this method is suited, Herco blasting powder replaces dynamite at a saving often as high as 35%.



The Explosives Engineer on the job

from the film: THE EXPLOSIVES ENGINEER—FORERUNNER OF PROGRESS



The success of enormous blasts depends on his skill



He removes menaces to navigation



He excavates for mighty skyscrapers

HERCULES

Dynamite—Permissible Explosives—Blasting Powder—Blasting Supplies

Free Booklets on Effective Blasting Methods



A Hercules Rheostat is valuable to the blaster in testing the capacity of his blasting machine.



Hercules Electric Blasting Caps are also made in two strengths, Nos. 6 and 8. They are dependable and have several distinctive features.



Hercules No. 2 Blasting Machine, 1 to 10 cap capacity.



Hercules Blasting Machine, 1 to 50-cap capacity.



Hercules Extra L.F. is adapted for general all-around work. It is one of the economical ammonia dynamites.

Choose Explosive

THE success of these and all other Hercules products depends upon their performance on the job. The choice of the right explosive for the work, and the correct blasting method, are just as essential as the merit of the powder itself. So, in order to help customers to use Hercules explosives to the best possible advantage, valuable booklets on blasting are frequently issued for free distribution. These are in every respect practical; they are written by men trained in the use of powder as well as its manufacture. Many customers have told us that these publications have helped them to increase their output and effect savings. Look at the list on the right, check any of the booklets you want, and mail the coupon.

"The Explosives Engineer—Forerunner of Progress" is the title of a motion picture film that illustrates the part played by men who move materials with explosives in the great industrial undertakings of our times. It shows how engineering methods have transformed blasting from an uncertain, hit-or-miss operation into a science based on mathematical calculations. It also takes you behind the scenes in the great testing laboratories maintained by the United States Bureau of Mines and by the Hercules Powder Company, and shows the care that is exercised to provide the user with explosives that are as dependable as his figures.

Another film shows the manufacture of Hercules Electric Blasting Caps. It illustrates the advantages of the larger diameter cap shell, adequate water-proofing, and the platinum bridge which are features of this product. You may show these films without charge. If you want one or both of them, fill in the coupon. They make excellent additional features to the regular bill at moving picture theatres in communities where there is some interest in mining, quarrying or construction.



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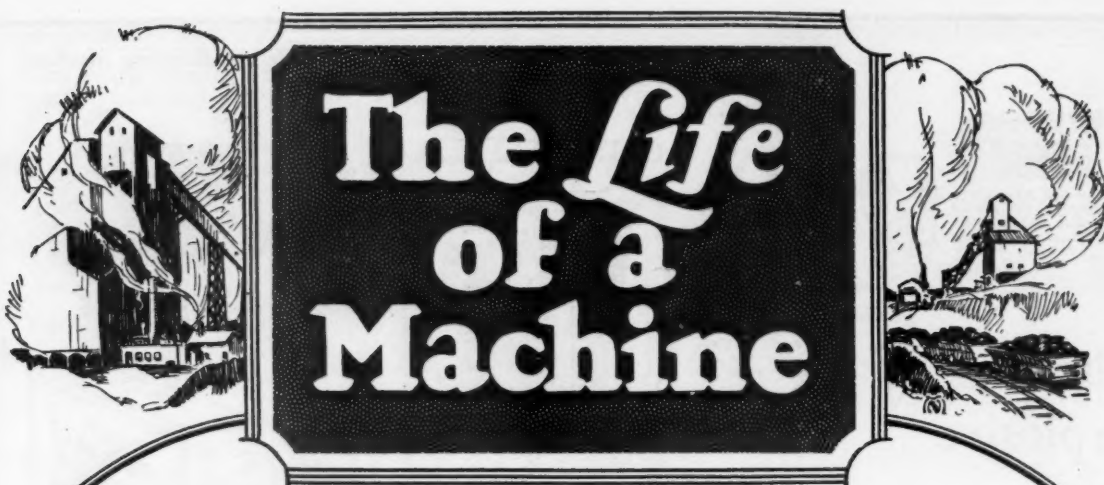
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(Date)

☐ "THE MANUFACTURE of ELECTRIC BLASTING CAPS" on.....
(Date)

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ADDRESS



THE life of any piece of machinery depends upon the lubrication it receives. Everybody knows that if a machine is run without oil or grease it will soon wear out. But many people do not seem to realize that friction still exists, though in a lessened degree, even when the machine is thoroughly lubricated.

No lubricant can do away with friction entirely. The best that it can do is to reduce the friction to the least possible amount. The degree to which friction is reduced depends upon the quality of the lubricant and its suitability to the bearings on which it is used.

That is the reason why "just any oil or grease" will not give satisfactory results. A low quality oil, or an oil which is not of the correct viscosity for the bearings on which it is used, will still permit enough friction to develop to cause premature wear.

Standard Oils and Greases

are lubricants of the highest quality, and are made in grades to suit the requirements of all industrial machinery in use today. When used in the correct grades they reduce friction to the minimum, prevent premature wear and reduce depreciation and repair costs.

To make sure that you get the right grades for your machinery, ask for a survey of your plant by one of our lubrication engineers. A letter or phone call to our nearest branch will bring one of our experts to examine your machinery and recommend the correct grades. No charge is made for this service.

STANDARD OIL COMPANY

(Indiana)

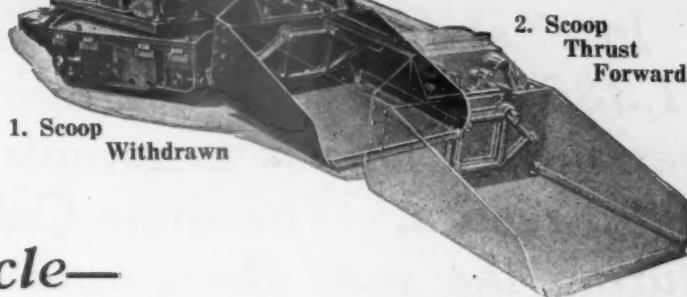
910 South Michigan Avenue

Chicago, Illinois



The GOODMAN Electro-Hydraulic POWER SHOVEL

3. Swung over the mine car—
Ejector Pushes Coal from Scoop



1. Scoop
Withdrawn

2. Scoop
Thrust
Forward

Its Simple Cycle—

A Thrust—a Lift—a Swing—Discharge

**Exactly as a Giant might
Wield a Half-Ton Shovel!**

And then, with hydraulic smoothness, the Scoop withdraws to its inward position, swings back and is lowered to the mine bottom for another load—

all in one continuous operation—

a full circle of 360 degrees, if desired.

A power jack to the roof holds the machine in rigid placement.

It's Electro-Hydraulic!

That's the secret of its Powerful Thrust and Lift!

And one 15-h.p. electric motor, which drives continuously a hydraulic pump, supplies all the power required. Yet this motor—less than half the size of a cutting machine motor—has ample reserve capacity. The power consumption therefore is surprisingly low.

Have You Investigated This Loader?

GOODMAN (59)
Locomotives - Loaders - Coal Cutters
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The COLODER

No coal loading machine has ever equalled the performance of the Coloder.

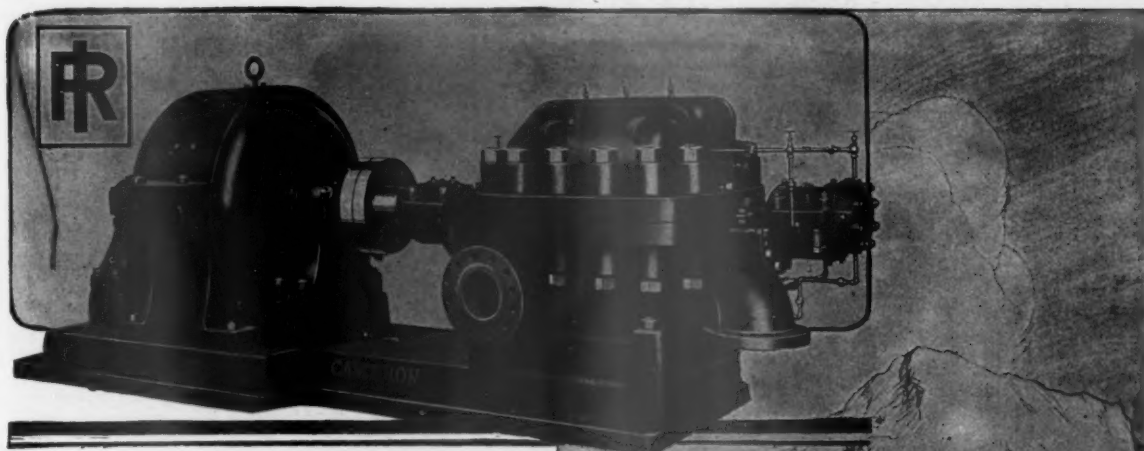
In 27 shifts in May a Type B Coloder loaded 11,385 tons of coal, averaging 422 net tons per shift. This is a sample performance---not a record. The same Coloder has loaded, during the past three and one-half years, 400,000 tons of coal.

120,000 tons in one year---14,000 tons in one month---568 tons in one eight-hour shift---110 tons in one hour: These are the high records of the Coloder.

Peak performances in loading machines are valuable only to show potential capacities and to provide comparisons for average mine conditions. Naturally, the average yield is the basis of cost and estimate.

*The Coloder stays on the track, and it
stays on the job, too*

THE COLODER COMPANY, Columbus, O.



Mine Pumps

Cameron Pumps have proved their superiority in the handling of acid-laden mine water.

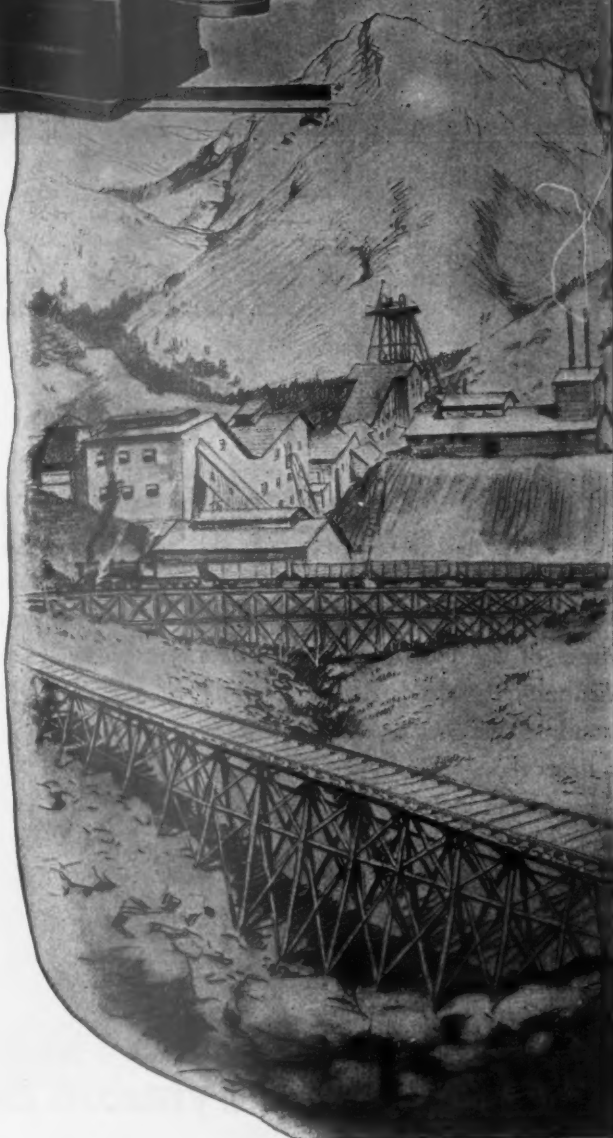
Ofttimes isolated from the engine room and unattended except for an occasional oiling, they run on indefinitely—doing their jobs as only superior pumps can.

Ingersoll-Rand Company's vast experience with mining conditions, together with Cameron's experience in pump design, makes possible the building of mine pumps exceptional in their durability, economy, and low upkeep cost.

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A. S. CAMERON STEAM PUMP WORKS



On all mine equipment —NCC Brushes

ALL the equipment of the Virginia and Sayre Mines of the Gulf States Steel Company uses National Pyramid Brushes, and we are as proud of this fact as the Gulf States Company is deservedly proud of its mines. For these mines are modern in every respect, thoroughly electrified, safe as mines can be, and economically operated. Each mine produces from 1000 to 1200 tons of coal per day. National Grade 401 is used on the 6-ton electric locomotives,

which are supplied with current at 250 volts. On the motor generator sets, National Grade 255 is employed.

In the show places of many industries you will find National Pyramid Brushes, doing their part in maintaining the perfection of the whole. Our Sales Engineers, men of diverse experience, are eager to help you with advice on brushes and correlated subjects. Ask about our Data Sheet Service.

National Pyramid Brushes

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Cleveland San Francisco

*Unit of Union Carbide and Carbon Corporation
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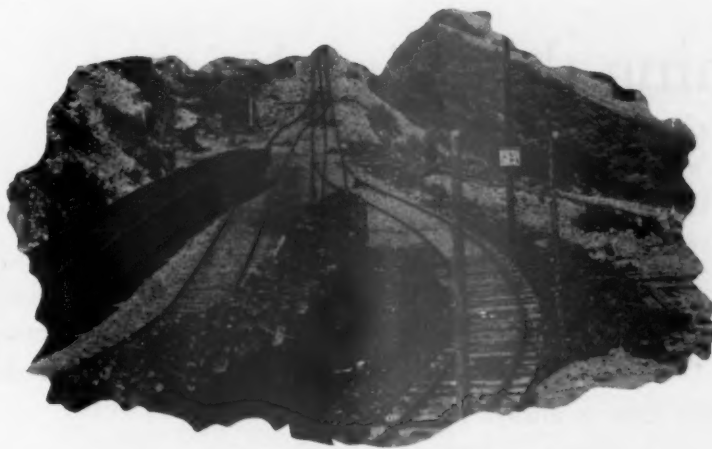
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7th Floor, Arrott Power Bldg. No. 3
Barker Place, Phone: Atlantic 3570

NEW YORK, N. Y.
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Phone: Lackawanna 8153

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Blue Center Steel Wire Rope

is used where equipment is purchased on the basis of lowest ultimate cost over a long period of years. It is constructed to withstand the strains, abrasion and sudden pulls to which mine ropes are subjected and is the choice of particular engineers because of its dependability. There is a Roebling Rope for every purpose.



John A. Roebling's Sons Company
Trenton, New Jersey

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Light-ening the Miner's job

THE MINER has to carry his own lighting equipment. So it is no wonder miners are quick to adopt a device that will make the job easier. That's one reason why more than a million miners are using carbide lamps today.

The carbide light is always focused where the miner is looking. Whether he is standing, kneeling, or lying on his back, the light is always directed where it is most needed. There are no cables to interfere with the free movement of his head. And the volume of light is

easily regulated. It can be increased or decreased as the miner wants it.

Union Carbide contributes its share to better working conditions. Its purity and high gas yield have brought it recognition as a world's standard in mine lighting.

UNION CARBIDE SALES COMPANY
Unit of Union Carbide and Carbon Corporation



Carbide and Carbon Building, 30 East 42d Street
New York City

PEOPLES GAS BUILDING
Chicago, Illinois

ADAM GRANT BUILDING
San Francisco, California

Union Carbide Warehouses in 190 Cities

"Longer Life Lower Maintenance"



Enterprise Cars are among the Timken-equipped makes in the Stonega Derby mine, at Big Stone Gap, Va.



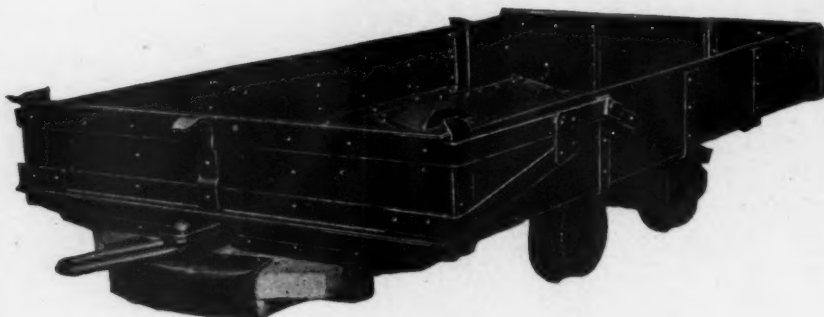
"OVER a period of two years," says W. C. Shunk, General Manager, Stonega Coke & Coal Co., "our experience has been that these Timken-equipped cars are dependable, easy-running, and require less lubricant. Our opinion is that the ultimate life of both bearings and wheels will be longer, and the maintenance cost lower, than on other types of bearings we have in use."

The whole mining industry is establishing endurance, production and cost records with Timken-equipped cars. Labor, power and lubricant are saved by the easy-rolling qualities of Timken Bearings. Lay-ups, delay and shop work are saved by Timken endurance. Timken tapered construction, Timken electric steel and *POSITIVELY ALIGNED ROLLS* scientifically carry the utmost radial load, thrust and shock, without any auxiliary members, and with no moving contact at all on axle surfaces!

Merely a few greasings yearly insure Timken-equipped cars against every form of journal wear and waste.

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"Not a nickel for repairs" is a favorite expression from users of Enterprise Cars. The strike will probably continue until fall, possibly longer. This is the coal man's opportunity. Get on the band wagon and prepare for the rush of business which is sure to come. Practice some Coolidge economy and try Enterprise Cars on your next order.

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Carnegie Mine Ties are made of copper steel. Wood ties rot. Ordinary steel ties rust. The copper content of Carnegie Ties greatly retards corrosion, thus assuring a much longer period of usefulness.



Recent improvements in Carnegie Ties increase their efficiency. Through better distribution of metal, the new sections have greater strength without increase in weight. The outside fastening has also been redesigned to eliminate any tendency of the rail pushing under the clip.

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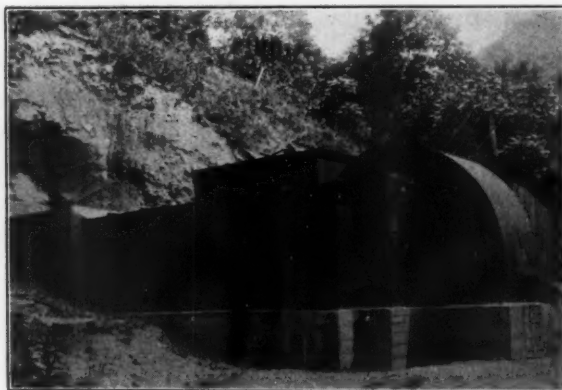
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Mill and other buildings of The Tomboy Gold Mines. The altitude at the shaft house is 11,600 feet above sea level.

A Twenty-three Year Service Record



Surface buildings of the Tomboy Mines. There are about 30 miles of underground workings

ON November 15, 1904, the Tomboy Gold Mines Co., Ltd., placed its first order with the du Pont Co. for 25,000 blasting caps. From that day these famous gold mines in the Telluride, Colorado, district, have been supplied entirely with du Pont Explosives and blasting accessories and serviced by du Pont exclusively. Twenty-three years of "prompt, efficient and courteous treatment," in the words of the general manager, Mr. N. S. Kelsey. It's a record significant of all the principles and policies maintained by E. I. du Pont de Nemours & Co. since its establishment just one hundred and twenty-five years ago.

The Tomboy Gold Mines, discovered in 1882, are among the oldest in this country. The present company, incorporated June 7, 1899, succeeded The Tomboy Gold Mining Co., a Colorado corporation. These mines have paid over \$10,000,000 in dividends.

With the strident competition and swift changes now prevalent, the action of The Tomboy Gold Mining Co. is significant. Furthermore, such action evidences confidence in the quality and performance of du Pont explosives, an assurance of ample supplies and the rendering of prompt, efficient and practical service by explosives experts whenever necessary.



Powder train on one of the trails in the Telluride District

E. I. DUPONT DE NEMOURS & CO., INC.

Explosives Department
WILMINGTON, DELAWARE



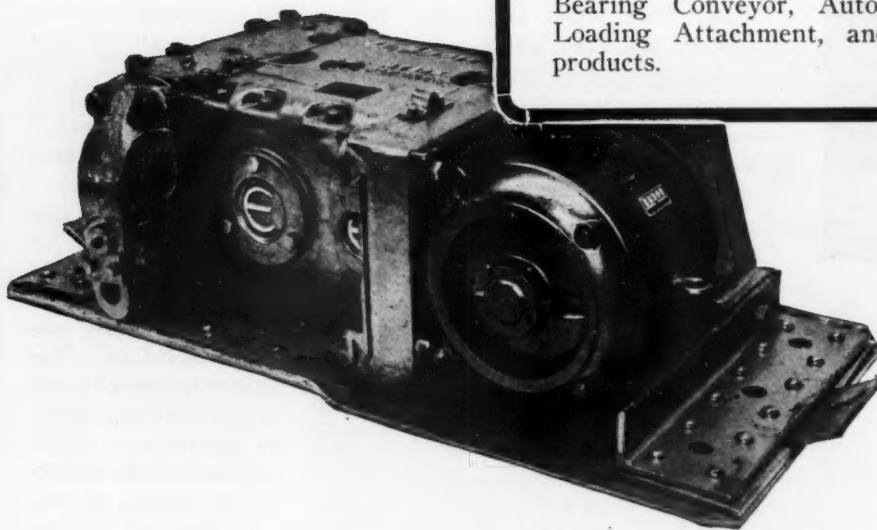
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Manifesting, in every feature, inbuilt power and precision that is a credit to the engineering skill and experience of its creators, the MTA-15 Drive (for intermediate duty) is applicable to more conveying requirements than any other drive.

Originating in a factory that has set the pace in jigging-conveyor design for a quarter of a century, the MTA-15 represents the same high standard of value as the Eickhoff Ball Bearing Conveyor, Automatic Duck Bill Loading Attachment, and other Eickhoff products.

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THE RAILROAD CONSOLIDATION DEADLOCK

ALMOST SIX YEARS AGO the Interstate Commerce Commission announced a tentative plan for placing the railroads of the country into groups. Since that time many applications have been filed with the Commission for permission to consolidate or acquire control of certain lines, but only in a few instances have these applications been approved, and in no instance has the Commission approved a comprehensive consolidation. And the adverse decisions on the Nickel Plate Plan and that involving the Kansas City Southern, together with the adverse report of the Commission's examiner on the application of the New York Central to lease the Michigan Central and the Big Four, have created such uncertainty in the minds of those who have followed developments as to make it practically impossible to undertake to interpret the Commission's requirements or to offer an opinion as to how they may be met.

From responses to a questionnaire submitted to a selected and representative list of 500 leaders in practically every profession and branch of industry throughout the United States, the Division of Mining Economics of the American Mining Congress finds that the general consensus of opinion favors voluntary consolidation, but that "individual freedom of action" is greatly curtailed by the attitude of the Commission and of Congress, and their policy concerning consolidation—declared in the transportation act to be in the public interest—must be modified in order that results originally hoped for may be realized. The Commission already has asked Congress to relieve it from the responsibility of making a complete plan, but Congress thus far has failed to act upon this request. Therefore, no one has any definite idea about what the future may bring forth. Will Congress act as requested by the Commission, or will it direct the Commission to make a further attempt to function in the matter under the transportation act, or will the Commission ultimately decide to proceed further without action by Congress? No one knows the answer.

In some responses to the questionnaire, reported elsewhere in this issue, the view is expressed that consolidation would result in lower freight rates; but this view has been negated by a statement of Commissioner Eastman, who, as chairman of the Commission, last year presented the majority views of that body before the Senate Committee on Interstate Commerce. Others seem to think that consolidation would tend to strengthen weak lines, bring about greater operating efficiency in the transportation structure as a whole, and possibly give to certain areas essential service that they now lack. On the whole, the public, if the responses are truly indicative of public opinion generally, is as much at sea about how a policy of consolidation may be made properly effective, as appears to be the case with the Commission and Congress. Thus, the matter seems to be progressing nowhere.

One thing seems certain; the Commission holds the key to the situation at present. Its powers, whether assumed or expressly granted, are far-reaching, and its exercise of authority generally is upheld by the courts. While it may not compel consolidations, it can prevent any and all voluntary consolidations which it does not approve—at least, it has prevented several such consolidation plans. Thus, with the railroads in doubt about what is expected of them, with the Commission in doubt about its future policy in the matter, with no indication whatever concerning what Congress may do, and with a wide divergence of opinion everywhere as to the possible consequences of consolidation, either voluntary or compulsory, the situation is most deplorable.

We believe any extension of the Commission's authority in this direction should be opposed. We believe the railroads employ sufficient brains to work out their problems in the interest of the public, since public welfare is essential to their prosperity. We believe private initiative and judgment are far superior to Congressional action or bureaucratic authority as a guarantee of transportation efficiency. And we reiterate the slogan heretofore used in these columns—"let the railroads alone."

A SURVEY on five outstanding national questions has just been completed by The American Mining Congress.

A MAGNIFICENT SURVEY

Taxation, Public Lands, and Government Control of Industry.

The results obtained by this survey are interesting indeed and show a definite trend of opinion; but what is more important is the fact that this group of men and women, representing a real cross-section of our citizens, *have opinions* that are not arrived at haphazardly, but are based upon a real foundation of thoughtful study. They show that the people generally are sufficiently well-informed concerning the activities and policies of government to determine for themselves whether this or that law, executive department or administrative bureau is functioning efficiently or not.

The whole trend shows decided conservatism, and an almost unanimous demand for government to keep out of competitive business with its citizens; an opportunity for the railroads to work out their own salvation; the futility of the five-day week, and an abiding faith in Uncle Sam's time-honored policy of dealing with the public lands as against new public land proposals of recent years. On taxation the opinions, while varied, show a unity of thought in so far as wise and sane taxation of industry is concerned.

The replies to the questionnaires make interesting and informative reading. The first of a series of five articles, based on these replies appears in this issue, and succeeding issues will carry the remaining four discussions. It will hearten the most pessimistic citizen to read these replies, and to realize that these sound doctrines represent the rank and file of American life.

There is no cause for alarm concerning a people who think so soundly for themselves.

THE COGITATING in political and press circles immediately following Senator Smoot's announcement that October might bring an extra session of the Sixty-ninth Congress, is subsiding as the weeks pass and the President remains silent on the subject.

EXTRA SESSION AGITATION

On general principles the country does not approve of extra sessions, and at this time sentiment is largely against calling such a session this fall. The country is enjoying a respite from "smelling investigations" such as characterized the last two or three Congresses, and it is not keen to have old cankers lanced or new ones started.

There is every reason to believe that if an extra session is called the now simmering political pot will begin to boil and steam over the fires of more than a score of proposed investigations that were lighted and left smoldering when the last session adjourned.

So far as the mining industry is concerned, little can be gained by an extra session, and certainly considerable annoyance and uncertainty would result if Congress is called together prematurely. The closing session of the last Congress left a mass of legislative proposals directed at mining that would immediately spring to life, and add to the burdens of an industry that has handicaps enough at the present time.

It is not far-fetched to assume that if Congress meets in extra session many issues will be raised, and investigations started, that will retard consideration of the necessary business that is scheduled to be taken up at the regular session in December. It is not unwarranted to conclude that certain members of the House and Senate have political aspirations that would make an extra session a most desirable vehicle upon which to carry through some of their plans.

Among the many questions that would be dropped into the hopper of a special session are the tariff—its abolition, decrease or increase; taxation, with its numerous ramifications; and coal legislation. The coal industry, harassed as it is with labor troubles, competition, frayed markets, and many other problems, needs not the crowning touch of threatened confiscation, or the agitation resulting from revival of a horde of proposals that have sprung up at each previous session of Congress during the last few years.

It is perhaps unfortunate, but nevertheless true, that immediately Congress assembles, industry generally is placed on the defensive; for notwithstanding all of the evidence to the contrary, a surprising number of political leaders and theorists believe legislative castor oil is good for all of our so-called national ills, and particularly for the mining industry.

If there must be a special session of Congress let the President make clear its purpose, and assure industry that legislators will be expected to confine their efforts to that task. For the last ten years, particularly, in-

dustry has had to withstand a barrage of political assaults. It is weary. It should have a rest, and the respite even to December is entirely too brief.

The mining industry will utter a fervent amen to a negative to all special session proposals, excepting only one—which may become advisable and necessary to give relief to the homeless and hungry half million victims of the Mississippi flood. The authorities in charge of flood relief work, who know actual conditions, should determine this question, and should act according to the needs of those whose very lives may depend upon their decision.

EVENTS HAVE BEEN MOVING RAPIDLY in the coal-mining industry. From behind the smoke screen that has camouflaged the true situation there is emerging a clearer understanding of the industry's helpless condition. The situation in Illinois stands out as an example of the economic paralysis that grips the industry. The im-

THE INDEMNITY BOND

possibility of operating coal mines in that state, under the stress of present economic conditions incident to the inability of the operators to meet wage demands, and under the handicap of uneconomic conditions saddled upon the industry by unwise legislation, is proved beyond question.

If further proof of this fact were necessary, the labor representatives themselves furnished it at their recent conference with Illinois operators. They stated that the miners had suffered a loss of over \$1,000,000 in wages from companies that *have gone into the hands of receivers*. They asked a bond of \$1,000,000 to indemnify the miners against such a loss in the future. Thus they recognize the improbability, if not the utter impossibility, of the industry being able to operate on the scale of wages they demand and keep out of receiverships.

If this is their reason they are right, but why a bond? It is high time that the miners' union came to a realization of the state of chaos for which they are responsible. The coal industry of Illinois is in a most uncomfortable position. This is equally true of the mine workers. If it affords any satisfaction, each may know of a certainty that the other is in a most unhappy situation. But that does not solve the Illinois problem.

While the miners are losing wages, and the miners' union is losing revenue from the check-off, what of the operator? He is losing a staggering sum, and his losses may be projected into future years even after resuming operations. By comparison the amount claimed as indemnity for the workers is infinitesimal. Certainly there must be some way out of the dilemma besides the rule of the survival of the fittest. In such an impasse, who can hope to win?

The best solution would be for the mine workers to assert themselves and insist that the union permit them to go to work at a wage the operators can afford to pay. And the conditions that now prevail are such as to practically insure to the workers that the operators actually will pay willingly all they can afford to pay in order to resume operations, irrespective of what some individual operator might be willing to pay if he were in a position to dictate his own terms, which is not the case. We believe the rank and file of the mine workers have come to this same conclusion. Will they continue to hold out at the behest of their leaders?

WITHIN THE PAST SIX MONTHS the American Engineering Standards Committee, a recognized authority in the development of standard practice for industry, has approved four major projects of the National Standardization Division of The American Mining Congress, as standard practice for the mining industry.

ENDORISING MINE STANDARDS

These projects include codes for Underground Power Transmission and Equipment, Mine Tracks and Signals, Wire Rope, and Drainage Equipment.

Each of these finally approved standards represents more than seven years of continuous effort on the part of committees studying, investigating and correlating information upon these subjects. The committees have been composed primarily of mine operators and the manufacturers of equipment. They also have included representatives of the United States Government and consulting engineers. After the committees so composed made their recommendations, it was necessary for them to pass the acid test of an entirely new agency made up of representatives of all of the national organizations directly or indirectly interested. Thus the mining industry is assured that the recommendations that are published through the Handbook of Mining Methods, Practice and Equipment, are the most complete, the most reliable, and the most able that can be obtained. They are recommendations arrived at through a most reliable, although somewhat tedious, process. Long before the necessarily slow moving machinery of the American Engineering Standards Committee gave endorsement, the industry had literally applied the recommendations and found them of distinct value. The industry's good judgment has now received the endorsement of an agency representing not alone mining but all allied and kindred industries. These standards are vastly worth while. Mine operators will find it decidedly profitable to investigate them.

SOME WILL EXPERIENCE a feeling of regret, although almost everyone will sigh with relief, if the present situation in the coal industry results in the demise of the miners' union. Coal operators generally have been frank in saying that they do not wish the union abolished. It has served many useful purposes, and has a splendid

THE PASSING OF UNION DOMINATION

opportunity, even now, for constructive work—which, however, can not be accomplished by it as now directed. In the present crisis, the union is facing a stone wall. When the strike began there was approximately 75,000,000 tons of coal in the stock piles. Non-union production has kept so nearly even with consumption that the government agencies now estimate that when the fall increase in consumption begins there will still be several million tons on hand in the stock piles. In addition to this fact, field after field is reopening on an open shop basis and is augmenting the present record breaking non-union production. Pennsylvania is well in the lead with mines that formerly were union producers going over to the non-union basis, Ohio has issued her ultimatum, and means to live up to it; and even Illinois, handicapped as she is with the unspeakable certificate law, is holding her own, and will not back down in her position against accepting a scale that means complete bankruptcy.

In the meantime the nation goes vacationing, worrying little about the coal industry, and giving no thought to next winter and the coal supply. The non-union districts are working with unprecedented speed, and every indication points to a surplus instead of a deficit when the consumption peak is reached this fall.

What then about the miners' union? And the Jacksonville scale? With the fuel supply readily available there will be no public clamor for legislation. With labor offered good jobs on a non-union basis, without a union check-off against their Saturday payroll, the ranks of the union will continue to diminish, and it is unlikely that these men will heed a national strike call.

The union to save itself must change its position. Unless it yields from its impossible demands, evil days seem to be upon it.

THE MAJORITY of coal mine operators do not know the extent to which mechanized mining has been developed.

MECHANIZED MINING

The number of failures and the unsuccessful experimental work in the past has led many to the erroneous conclusion that mechanization can not be widely applied, and it is not generally known that quite a number of mines

are producing their entire output by mechanical loading, scrapers or conveyors.

The investigation upon the possibilities of mechanical mining begun early in 1927 by G. B. Southward, under the auspices of The American Mining Congress, is epoch making. The results of the investigation are startling and give an amazing view of mechanical mining—successful mechanical mining—as adopted and utilized by the coal mining industry.

Mr. Southward has completed his preliminary field work, and has released through the July issue of THE MINING CONGRESS JOURNAL the first four individual reports on the properties visited. These reports covered room and pillar with mechanical loaders. The August issue shows four modified room and pillar systems with hand shoveling on conveyors. With each group published there is a general descriptive article calling attention to the outstanding features of details of the operations.

The first object of the survey and reports is to show how mechanization has been developed and is being successfully operated. These reports do not show experiments or failures. These may be shown later and the causes investigated, which we believe, in the light of the remarkable progress made by many companies, will overcome many of the difficulties hitherto encountered in the experimental work.

The survey, which includes 30 operations showing mechanical loaders, scrapers, conveyors in room and pillar, longwall and modified systems, shows a sufficient number of successful operations, with a variety of methods and equipment to conform to physical conditions, to raise the question as to whether the old hand methods can expect to compete against mechanized mining and can survive in the face of an increasing mechanized production.

The reports are not attempting to give a positive answer to this question but are showing the accomplishment as it exists today, and this accomplishment may very likely be indicative of future trend and development. Coal operators, therefore, who hope and expect to continue in the mining industry will do well to avail themselves of this opportunity, now being offered, to study and analyze mechanized mining as it exists today.

THE STAFF of the Joint Congressional Committee on Internal Revenue Taxation is buckling down to the

TAX SIMPLIFICATION

task of analyzing the income tax law, regulations, and system of procedure for the purpose to the next Congress. of simplification to be proposed to the next Congress. By October a number of important phases of the income tax system will be covered in reports of the staff to the joint committee. In pursuance of their studies counsel and engineers of the committee have sought the advice and cooperation of taxpayers as well as the Treasury so that the views of both could be compared and utilized in attempting to build up a more satisfactory structure. The outlook is exceedingly hopeful.

It has been said that 95 percent of the taxpayers are honest and are meticulously scrupulous in preparing their returns of income; but that 5 percent seek to avail themselves of loopholes in order to avoid payment of their fair proportion of the tax burden. And for this reason, it is said, intricate and detailed technical provisions of law have been necessary, even though their rigid application may have been confined to a comparatively small number of cases. Thus, the joint committee is confronted with the problem of simplifying the system, and at the same time preserving provisions that are considered necessary safeguards against tax evasion. It is pointed out that provisions of law that prevent 5 percent of the taxpayers from escaping just taxation, benefit the other 95 percent who otherwise would necessarily have to pay a disproportionate tax.

Among the more troublesome sections of the law on which revision will be recommended are those relating to interest, gain and loss, limitation periods, reorganizations, instalment sales, exchanges and transfers, affiliated companies, credits and refunds, and appeals. Some of these sections may be completely redrafted. It is probable also that the administrative provisions will be codified in order that administrative questions may be divorced from the question of rates in the future. It is expected, too, that the joint committee will recommend a more satisfactory definition of statutory net income, in connection with which a clearer statement of credits and deductions doubtless will be incorporated in the bill to be proposed by the committee.

The committee not only will make recommendations with respect to revision of the law, but will undoubtedly propose changes in the personnel and procedure of the income tax unit and the field organization of the Revenue Bureau which can be made effective by the Commissioner of Internal Revenue, if he approves, under the authority he now has. The committee recognizes the needs of the taxpayers, and is earnestly striving to find solutions for the many problems of administration that have made compliance with the income tax law so expensive in the past.

It is a noteworthy fact that this committee is proceeding in an orderly, constructive, and systematic manner to perform the duties outlined for it in the 1926 act, and taxpayers may accept its invitation to cooperate by making suggestions and by furnishing special information, without reservation, when called for, which can not conveniently be assembled from the records of the income tax unit. For example, in the study of depletion allowances to the mining industry, some information has been or will be called for which the income tax unit can not assemble for the committee in the form desired. The fact that depletion is being studied does not mean that any change will be made in the bases for this capital

allowance now established. The study is said to be simply for the purpose of determining whether or not an alternative basis can be evolved that will eliminate the difficulties of intricate valuations in the future, and not with the intention of disturbing those already made. The mining industry will await with interest the results of this study.

Taxpayers have a real opportunity now to ask for what they want in the way of changes in the income tax system. First, they must recognize that it is to be the backbone of the Federal taxation system for many years to come, and therefore it is useless to urge its abolition as some taxpayers have done. Second, they must remember that the Government must have sufficient revenue to meet its obligations. But beyond these points, members of the joint committee and of the House and Senate as a whole are open-minded and are in a receptive attitude to consider seriously every suggestion for improvements in the system that will lessen the administrative burden and the cost of compliance with the law.

LAST MONTH we called attention to the astonishing and somewhat misleading accident statistics published by the Bureau of Mines. Figures *en masse* are always misleading, and any industry's accident toll may be cause for headlines when issued without contrasting data.

THE SPIRIT OF SAFETY

While admittedly a hazardous industry, mining is by no means at the top of the list. Its death and accident rate is appalling enough and certainly will stand improvement, but when we consider statistics in conjunction with other industries, mining is no better, but certainly no worse than other industries.

We do not offer the above as condoning the accident record of the mining industry. Far from it. Its record is not a thing to be proud of. With the rest of those striving to bring about mine safety, we are chagrined that the result has been so comparatively fruitless.

But the "Spirit of Safety," like our beloved "Spirit of St. Louis" is on the wing, and month after month individual companies are piling up records, which if maintained, will at the close of another year make mining safety records something to which the industry can point with pride. A number of companies are reporting "no accident months," and silver cups and bronze statues have just been awarded certain companies with outstanding safety records.

These are the things we are striving for: Individual interest in safety; safety applied to your person and our person; your family and our family; the mine worker, his boss and the entire industry. Safety must start with the individual. Its growth may be inspired and interest in it intensified by various methods; but until the miner himself, until the mine foreman, superintendent, manager—every man connected with mineral production—makes his own safety and that of his fellowmen his business, all of the editorials, all of the criticism of safety records, all the legislation in the world will not prevent one accident. But if this editorial awakens in the mind of one individual his own sense of responsibility, it will have accomplished more than any law could hope to attain. Safety is emphatically not a legislative problem. It is a human problem. Every executive—no matter how little executive authority he has—should immediately adopt a slogan of safety, and make his own record worthy of a medal of honor whether he has any one to pin it on him or not.

If the mining man wants to know how other companies are establishing their safety records, he has only to communicate with any one of at least twenty-five organizations that are giving mine safety serious consideration. Information will be furnished him that may be of considerable value in solving his problem. We will be glad to answer any and all queries on the subject of safety, or refer the mine operator to the agency that can best serve him.

The Spirit of Safety—means individual consciousness of responsibility.

A FEW MONTHS ago we published a series of articles by a prominent California attorney which primarily dealt with the public lands question of the West, but which criticized in no uncertain manner the present trend in our Government toward bureaucracy and advocating the abolishment of the so-called "empire within an

BUREAUCRACY AND THE GOVERNMENT BUREAUS

empire."

Beginning with this issue the United States Forest Service begins a series of three articles, in answer, presenting the bureau point of view, as well as the aims and achievements of government under present policies.

We have long opposed bureaucracy. We have continuously opposed every effort to perpetuate bureau rule. Our reasons have been oft repeated, but may bear reiteration: Bureaucracy means political control, which in turn means no settled policy and changes in policy with a change in administrations. No bureau, however ably manned, can hope to efficiently conduct a business operating thousands of miles from base. Alaska is an example and a victim of bureaucracy.

Our opposition to so-called bureaucracy is based upon the fact that bureau control in numerous instances is operating as a check upon private initiative and judgment, perhaps preventing the construction or refinancing of a railroad, or denying authority for the merger of industrial units where consolidation may prove to be an economic boon; or so restricting the opportunity for mineral exploration on the public lands that prospecting must be abandoned; or by building up a system of tax administration that keeps the taxpayer in a state of uncertainty concerning tax liability for years, when a few months at most ought to suffice for the adjustment of taxes.

The desire of the people for a sound, conservative and efficient government is being made known. Radical tendencies of the last few years are being definitely checked. The people know what they want and they intend to have it.

There has been in the past ten years a vicious tendency to increase rather than decrease bureau control of natural resources. We accept with as good a grace as possible the necessary bureaus—bureaus created under the theory that "the function of government is to do those things for the whole people, which the people can not do for themselves"—but we are opposed to an extension of any system that saps national pride and state and individual initiative.

There are, of course, exceptions to the rule, and Colonel Greeley points out many reasons for the existence of the Forest Service, which are applicable to many other bureaus and which will meet the hearty approval of all. The Forest Service has done splendid work in the prevention of forest fires, in propaganda for re-

forestation, and in other forest protective measures.

Bureaus are necessary in the proper conduct of the Government under which we live. Their wise and judicious management is imperative if this form of government shall prosper.

BLUE SKY LEGISLATION does not afford protection to the investing public. Blue sky commissions are

not infallible, and their judgment may be unscientific, warped, arbitrary and even influenced. Such commissions may show partiality in the case of individuals promoting an unsound and unsafe proposition, and for private or political reasons discriminate against or dis-

prove one that is meritorious and perfectly sound. Therefore, blue sky laws are not wanted or needed.

The underlying purpose of blue sky legislation is to afford reasonable protection to the investing public against the schemes of unscrupulous and fraudulent promoters. But it does not afford such protection. On the contrary, it has enabled unscrupulous promoters, in many instances, to operate more effectively by first securing sanction of their project by a governmental body, which may be influenced or controlled by politics, thus enabling him to proceed with the sale of stock to the public in the hope that the individuals he may approach will not subject his scheme to a careful investigation and analysis.

In attempting to control and regulate the financing of mining enterprises by legislation, the proponents of blue sky laws are seeking to have the Government do for the mining industry and investors what they can do more efficiently for themselves. The mining industry, through its numerous local associations, and its scientific men, can afford better protection to the public against unsound or fraudulent stock-selling schemes, than can any sort of a state or Federal agency.

Local real estate boards are working along this line. There is no movement for blue sky legislation to regulate or control real estate promotion schemes. And yet, many millions are lost annually by investors in real estate. Banks fail, and neither state nor national legislation seems to afford material protection to depositors. Why should there be an attempt to discriminate against the mining industry. Mining engineers, as well as real estate operators and bankers, have their code of ethics, and these ethics are indisputably sound.

The best protection uninformed investors can have against loss in unmeritorious or fraudulent promotion schemes, is assurance of the integrity and practical experience of the owners and management of new ventures in which they are invited to purchase stock. Such assurance is not afforded in consequence of any blue sky laws and commissions. The best method of obtaining such assurance is through acquaintance with owner and management, and a mutual understanding of the fundamental factors involved in the undertaking. Investors, who have in mind and appreciate the attractive possibilities of mining stocks and securities, are learning this, and are going out to see for themselves, preferring to rely upon their own judgment and impressions as to the character and possibilities of an enterprise, rather than to depend upon the conclusions of Government officials who may be prejudiced or influenced by factors entirely disassociated from the merits of the proposition. Intelligent citizens with money to invest do not require the guardianship of a Blue Sky Commission.

WHY A BLUE SKY GUARDIAN?

WESTERN DIVISION MEETING

American Mining Congress Session At Salt Lake Will Draw Interest Of Mining Men On Taxation And Metal Mining Problems—Large Attendance Anticipated And Splendid Program In Prospect—Mines And Smelters To Be Visited

REPORTS from Salt Lake, where the preliminary arrangements for the gathering are being made, are to the effect that the forthcoming sessions of the Western Division of the American Mining Congress to be held at that city August 22 will be largely attended by delegations representing the mining industries of the West and other parts of the country. The program is rapidly taking shape under the leadership of the officers of the Western Division, including Imer Pett and A. G. MacKenzie of Salt Lake, the chairman and secretary, respectively, of the Western Division.

At the present writing it appears that the most interesting and instructive feature of the program for the Western Division will be that relating to the question of mine taxation. Not only have the members of the Western Division taken an active interest in this part of the convention, but the parent organization, The American Mining Congress, through its national headquarters and staff, at Washington, has spent considerable time during the past few months in plans to assist the Western Division in affording detailed consideration at Salt Lake of the important provisions of the tax law which may be subject to change by Congress when it revises the law at its next session this winter. For the first time in a number of years the American Mining Congress has arranged for the holding of a meeting of the complete General Tax Committee, which is a part of its national organization and which has of late been giving, through studies by individual members, special consideration to provisions of the tax law affecting the mining industry. Heretofore the work of this general tax committee has largely been handled by a smaller group of its members in the form of its executive committee. But in consideration of the fact that the western mining interests are so deeply interested in the application and effect of federal tax rates and administrative provisions and the further fact that the whole revenue system will be subject to modification at the next session of Congress, the American Min-

ing Congress deemed the occasion of sufficient importance to issue a call for the assemblage of the complete General Tax Committee at Salt Lake at the time of the annual meeting of the Western Division in August. This action will afford western mineral producers an opportunity not only to hear and participate in the discussions of tax questions which will be conducted at the Salt Lake meeting by this General Tax Committee and the Tax Division of the American Mining Congress, but it will also enable them to mingle and discuss personally with the members of the Tax Committee the various phases of the tax law as they may apply to their individual mines.

Other questions to be considered at the meeting of the Western Division will be means of stabilizing the mining industry and workmen's accident compensation. The program has not as yet been definitely arranged according to a schedule of subjects and speakers, but it will be of sufficient interest to justify attendance of mining men who are interested in the progressive development of their industry. The meeting of the

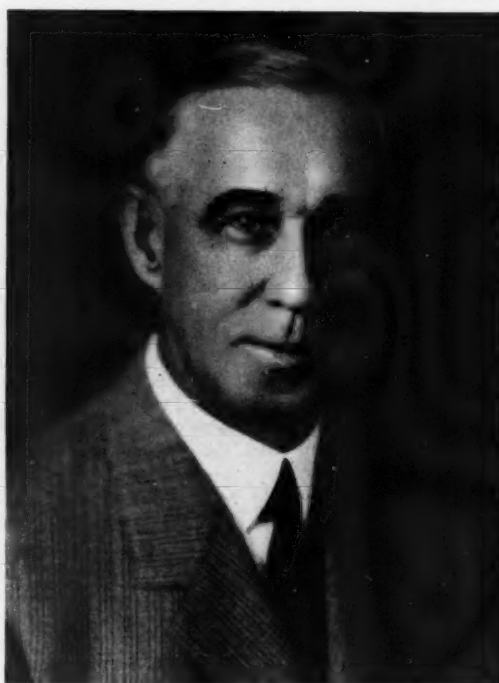
Western Division will be called to order by Mr. Pett and its first session will be presided over by L. S. Cates, Salt Lake, former president of the American Mining Congress. At an evening session the film of the Bureau of Mines descriptive of the copper industry will be shown to the delegates.

Meeting simultaneously with the Western Division will be the western regional meeting of the American Institute of Mining and Metallurgical Engineers and the governors of the American Silver Producers' Association. The meeting of the Institute will be the most important of that organization during the year and will consider ore dressing problems. The silver situation in its national and international aspects will be considered by the representatives of the silver association. The meetings of the Institute will be held August 23 and 24, while on August 25 the delegates will be entertained by the Utah reception committee, comprising representatives of the three associations, on tours to mining and smelting plants in the vicinity of Salt Lake. The meetings of all of these organizations will be featured by the election of new officers.

MINE EXHIBIT

Supplementing the convention sessions, an exhibit of mining products will be made under the direction of the Salt Lake station of the Bureau of Mines and the University of Utah. D. A. Lyon, superintendent of the station, and formerly chief metallurgist of the Bureau at Washington, is taking an active part in providing this exposition and in developing the program for the meetings of the Institute. The general program committee for the meetings consists of J. O. Elton, J. M. Boutwell, O. N. Friendly, Otto Herres, C. T. Van Winkle and J. W. Wade.

Electric shovel operations at the Utah Copper Company mine at Bingham, Utah, will be described at the meeting of the Western Division by C. W. Corfield and R. J. Corfield. The former is the electrical engineer and the latter the assistant electrical engineer of the company.



Imer Pett, Chairman, Western Division, The American Mining Congress

Preliminary Announcement

PROGRAM

ANNUAL MEETING OF WESTERN DIVISION
AMERICAN MINING CONGRESS
and
REGIONAL CONFERENCE

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS

Salt Lake City, Utah, August 22-25, 1927

MONDAY, AUGUST 22

(Western Division, The American Mining Congress)
FORENOON—Call to order, by IMER PETT, Salt Lake City, Chairman, Western Division.

First Session of the Western Division, LOUIS S. CATES, presiding.

AFTERNOON—Second Session of the Western Division.

EVENING—Showing of U. S. Bureau of Mines Motion Picture Film, "The Story of Copper."

Detailed program of Western Division will be announced later.

TUESDAY, AUGUST 23

(American Institute of Mining and Metallurgical Engineers)

FORENOON—NON-TECHNICAL PRESENTATION OF THE RELATIONS OF FLOTATION TO MINING, SMELTING AND THE STATE

J. O. ELTON, Manager, International Smelting Co., Salt Lake City, presiding.

Definition, Present Status and Future of Flotation
By ERNEST GAYFORD, General Engineering Co., Salt Lake City.

Flotation and Utah-Delaware Mine
By FRANK WARDLAW, JR., Superintendent.

Flotation and Park-Utah Consolidated Mines
By PAUL HUNT, Mine Manager.

Flotation and Utah Copper Mine
By E. E. BARKER, Engineer of Mines.

Flotation and Lead Smelting (Blast Furnaces)
By RICHARD A. WAGSTAFF, Asst. Mgr., American Smelting & Refining Co., Salt Lake City.

Flotation and Lead Smelting (Sintering)
By W. H. EARDLEY, Manager of Smelter, Utah District, United States Smelting, Refining & Mining Co., Salt Lake City.

Flotation and Lead Smelting (Zinc and Fluxes)
By A. B. YOUNG, Asst. Mgr., International Smelting Co., Salt Lake City, Utah.

Flotation and Copper Smelting
By R. W. SENDER, Supt., American Smelting & Refining Co., Garfield, Utah.

How Flotation Has Broadened the Geologist's Field
By PAUL BILLINGSLEY, Consulting Geologist, Salt Lake City.

What Flotation Means to Utah
By W. MONT FERRY, Managing Director, Silver King Coalition Mines Co., Salt Lake City.

AFTERNOON—TECHNICAL PAPERS ON FLOTATION IN THE UNITED STATES AND CANADA

GALEN H. CLEVINGER, Consulting Metallurgist, U. S. Smelting, Refining & Mining Co., Boston, Mass., and Chairman Milling Committee, A. I. M. M. E., presiding.

Flotation at International, Utah
By MEMBER OF INTERNATIONAL SMELTING CO. STAFF.

Flotation at U. S. Smelting, Refining & Mining Co. Plants

By A. B. MARQUAND, Assistant to General Manager, Salt Lake City.

Flotation at Utah-Apex Mine

By L. K. JACOBSEN, Metallurgist, Bingham.

Flotation at Combined Metals Reduction Co. Plant, Bauer, Utah

By R. J. EVANS, JR., Supt. of Flotation.

Flotation at Consolidated Mining & Smelting Co. Plant

By R. W. DIAMOND, General Superintendent of Concentration, Trail, B. C.

Flotation at the Hecla and the Callahan Plants

By W. L. ZIEGLER, Mill Superintendent, Hecla Mining Co., Gem, Idaho.

(Other papers to be announced later)

EVENING—Open.

WEDNESDAY, AUGUST 24

(American Institute of Mining and Metallurgical Engineers)

FORENOON—DORSEY A. LYON, Assistant Director, U. S. Bureau of Mines, Washington, D. C., presiding.

Technical papers on Flotation continued.

Discussion of Technical papers on Flotation.

AFTERNOON—ROUND TABLE DISCUSSION OF REFRACTORIES AND REVERBERATORY PRACTICE

CHARLES R. KUZELL, Supt. Smelter, United Verde Copper Co., Clarksdale, Ariz., presiding.

G. L. OLDRIGHT, Hydrometallurgist, U. S. Bureau of Mines, Salt Lake City, Secretary.

ROUND TABLE DISCUSSION OF MILL BALLS AND CRUSHING, DORSEY A. LYON, presiding.

The U. S. Bureau of Mines and the Department of Metallurgical Research of the University of Utah will arrange an exhibit in connection with the program to illustrate the subjects discussed.

EVENING—Visit to Saltair Beach resort at Great Salt Lake.

THURSDAY, AUGUST 25

Pleasure Trips.

Business sessions of the following organizations will be held on call during the meeting:

Board of Governors, Western Division.

Board of Directors, American Silver Producers Association.

General Tax Committee, American Mining Congress.

Facilities will be provided to enable those in attendance to visit Utah mines and plants.

All interested persons are invited to attend the public sessions.

Requests for additional information may be addressed to A. G. Mackenzie, Secretary, Western Division, Kearns Building, Salt Lake City.

A SYMPOSIUM ON NATIONAL PROBLEMS

Cross-section Of Opinion Covering Outstanding Professions And Industries—Taxation, Public Lands, Government Ownership, Railroad Consolidation And The Five-Day Week Considered—Constructive Theories Advanced

THE mining industry is closely identified with national progress. Any marked departure from familiar rules and procedure is of special interest to this industry. Methods of taxation vitally affect its prosperity and development; government ownership of industry is of more than ordinary interest, because it is to the natural resources that the government-ownership theorists turn first; railroad consolidation has many ramifications that specifically affect mining; the five-day week, a theory advocated in many quarters as a means of solving the labor problem for the mining industry, is of more than passing interest to this industry; and the public lands question is one of vital concern to our western mineral industries.

While all five of these questions are national in their scope, they apply with special force to the mining industry. But not to mining alone by any means. What is the attitude of the thinking people of the country on these questions? Are they for or against the general theories advanced by their proponents and opponents? Would their adoption make for the advancement of the nation? Would their defeat lead to better and more sound government?

The American Mining Congress being desirous of ascertaining the sentiment of thinking people on these and other national problems, recently sent out a questionnaire to a selected list of 500 names comprising 50 economists and tax experts; 50 bankers; 50 manufacturers; 5 producers of coal, 5 of iron, 5 of oil, 5 of natural gas, 5 farmers, 5 cotton growers, 5 lumbermen, 5 cement manufacturers, 5 wool growers, and 5 producers of clay; 50 wholesalers, which included 10 grocers, 10 clothiers, 10 stationers, 10 hardware dealers, and 10 jewelers; 50 editors; 50 national associations with offices in Washington; 10 university presidents and professors; 10 clergymen; 10 lawyers; 10 doctors; 10 engineers; 50 transportation heads; and 50 miscellaneous men and women in public life.

The first question submitted was:

Although our federal revenue laws have yielded sufficient revenue to meet the needs of the government, and in addition a substantial annual surplus which has been applied to reduce the national debt, the administrative difficulties of the income tax have been enormous. The Bureau of Internal Revenue is still many years behind in the work of auditing the large returns of both individuals and corporations;

the Board of Tax Appeals is already nearly two years behind with its work, with the number of appeals increasing constantly; and thus far Congress has been unable to remedy the situation. This prompts the question: What, in your opinion, is the matter with our federal income tax system, and how may it be simplified and made satisfactory from an administrative standpoint?

This is the first of a series of six articles upon public questions of direct interest to the mining industry. In this preliminary article a general survey is made of the result of a nation-wide questionnaire submitted to five hundred well known leaders. The following articles will condense briefly the consensus of opinion on each of the five questions under consideration. The September issue will present what we consider as a fair estimate of the public's viewpoint on the Public Lands question. The October issue will present the same estimate concerning Government Ownership of Industry; the November issue will present The Five-Day Week, and the December issue will consider Taxation from the National Viewpoint. The current issue discusses Railroad Consolidation.

The Editors.

To this question the percentage of replies received was as follows:

National associations.....	66%
Miscellaneous men and women in public life.....	48%
Editors	46%
Economists and tax experts.....	44%
Professional men.....	44%
Wholesalers	36%
Transportation heads.....	30%
Bankers	30%
Producers of raw material.....	26%
Manufacturers	20%

The same recommendation was made by many groups and all the replies to the taxation question are summarized as follows:

Simplify the returns so that a man of average intelligence can accurately make his return without assistance.....	30%
Employ more competent men in the Internal Revenue Department...	25%
Abolish the income tax and substitute a sales, severance, or direct land tax.....	14%
Give the district collector authority to make final settlement.....	12%

Place a time limit or "statute of limitations" on final settlements.	11%
Satisfied with things as they are...	6%
Miscellaneous theories.....	2%

Among the miscellaneous theories comprising the 2 percent of replies were the following:

Tax on the basis not of income received but of income spent; i. e., receipts minus expenditures, thereby avoiding the paradox of taxing the spender but little and penalizing thrift.

Income for the year should not be taxed when two or three times this income is lost in other years.

Congress should say what should or should not be taxed and then appoint a business committee of trained business men to write a tax law that is plain. Politicians have thus far written our tax laws.

The system is basically wrong. Originally a man's efficiency was rated on his collections. Taxes on personal incomes should be a definite percentage from \$2,000 to millions. Taxes on corporate earnings should be a fixed amount. The present law penalizes personal energy and intelligence. Large corporate earnings, instead of indicating good management, are deemed to be stained with fraud. Statesmen look upon successful business men as public enemies.

Have national banks act as collectors. Charge a fee on all appeals.

Under the present system corporations may receive an item three years after it accrues, without knowing at the time of the original report that they were entitled to income. The Internal Revenue Department credits such items back to the year of accrual instead of to the year paid, entailing extra work and the payment of tax for a prior year supposedly closed. Accrual should be accepted as returned.

Abolish tax-exempt securities.

The second question submitted was:

More than one-half of all the area west of a north-and-south line drawn through the eastern border of Colorado is still in federal ownership. In Utah, three-fourths of the area of the state belongs to the federal government; in Arizona and Idaho, 67 percent; Nevada, 87 percent; New Mexico, 43 percent. The taxable portion of these areas must police the whole state, build and maintain roads and incur other expenditures on account of the domain which they do not own.

When these states were admitted to the Union the enabling act granted them "an equal footing with the original states." Yet there remain 184,000,000 acres of unreserved and unappropriated public lands, 180,000,000 acres in sequestered parks and reservations, and 45,000,000 acres granted under the general leasing act. This

act has in effect a high royalty basis, which acts as a tax upon the Western States not assessed upon Eastern States having similar resources. In 1836 the 26 states then existing, divided up \$28,000,000 derived from the sale of public lands, and called it a "loan." Not a dollar of this has ever been repaid, either in principal or interest, and it stands on the books of the United States Treasury charged against the several states as "unavailable funds."

Proponents of the present situation maintain that Congress is better able to administer these vast areas than the legislatures of the several states.

Is it your judgment that these 400,000,000 acres should pass to private ownership and be made taxable, or that it should remain ever under the federal government as a perpetual landlord?

To this question the percentage of replies was:

National associations.....	58%
Economists and tax experts.....	54%
Professional men.....	52%
Editors.....	50%
Miscellaneous men and women in public life.....	48%
Bankers.....	36%
Wholesalers.....	36%
Producers of raw materials.....	34%
Transportation heads.....	30%
Manufacturers.....	28%

Opinion was rather evenly divided, 37 percent of the replies favoring private ownership of public lands, 34 percent considering that the federal government should continue in control, and 29 percent were unable to reach a conclusion.

The editorial, professional, and miscellaneous groups led in favor of private ownership of public lands, while the economists and tax experts led the opposite side.

A considerable number expressed the opinion that parks, mineral and oil lands, now known as such, should be retained by the government, while agricultural or irrigable land should revert to the several states.

Others consider that much of the public land would be a liability rather than an asset to any individual state. One correspondent states that the 1836 distribution was paid over to the several states as "loans" because of constitutional and other difficulties in the way of an outright gift; and that it was never expected that these sums would be returned. Several are of the opinion that the state is entitled to a substantial share of any revenue derived by the federal government from the public domain.

The third question submitted was:

During the past two years there has been much discussion of the invasion of government into private industry. This is exemplified by a wide range of illustrations. Its ramifications lead

from municipally operated street railway and lighting systems, into state-operated insurance, and construction of public works by day labor instead of contract, construction service by navy yards for outside parties, and the manufacture of clothing, paints, and many other articles in competition with private enterprise.

Taxes must be levied and collected or there will be no government. If all utilities were publicly owned the cost of government would be no less, while taxes necessary to defray the expenses of government would have to be raised through other sources.

State and local indebtedness represented by tax-exempt securities is increasing over \$1,000,000,000 annually. While federal taxes are being reduced, state and local taxes are being increased. The enormous annual increase of interest and sinking fund charges is not and can not be offset by economies in other items of public expenditure.

What measure or measures would you suggest to slow up the issuance of tax-free securities, and how may the increase in state and local taxes be curbed? What action should be taken to prevent further encroachments of the government in business?

To this question a wide diversity of views was received, and copious comments were expressed. The replies evidenced a deep interest in this particular problem, and by groups were as follows:

Economists and tax experts.....	86%
Editors.....	80%
Miscellaneous men and women in public life.....	78%
National associations.....	78%
Professional men.....	76%
Wholesalers.....	60%
Producers of raw materials.....	58%
Bankers.....	54%
Manufacturers.....	42%
Transportation heads.....	36%

The replies may be summarized as follows:

Absolutely opposed to tax-exempt securities and favoring legislative action prohibiting their issuance.....	72%
Favoring an ad valorem tax on securities at time of issue, favoring repeal of the primary system, advocating various methods of assessment and taxation, including variations in income tax rates, etc.....	15%
Opposed to any form of government in business.....	73%
In favor of government ownership.....	11%
Approving governmental regulation but not ownership.....	16%
Recommending state taxpayers' associations.....	23%
Advocating increased interest and activity by the individual voter.....	27%
Specific mention of the necessity for educating the people on basic principles of economics, taxation, and government.....	53%

The fourth question submitted was:

The five-day week recently sug-

gested by Mr. Ford has been indorsed by labor leaders. The National Association of Manufacturers and many employer groups have indicated their opposition.

Do you believe that efficiency would be maintained and production costs lowered by its adoption? Or would it tend toward increase in unit-production cost, thus adding to the general burden of the consumer?

The percentage of replies, by groups, was as follows:

Economists and tax experts.....	52%
National associations.....	52%
Professional men.....	52%
Miscellaneous men and women in public life.....	50%
Editors.....	48%
Bankers.....	36%
Producers of raw material.....	34%
Wholesalers.....	34%
Manufacturers.....	28%
Transportation heads.....	28%

Sixty-six percent of the total replies were opposed to the five-day week in any form for any phase of industry.

Nineteen percent were in favor of its adoption as an American standard.

Two percent believed it might be applicable in a limited number of cases but never as a national principle.

Thirteen percent said they had no opinion regarding the matter.

The fifth question submitted was:

The theory of railroad consolidation is that the strong and highly profitable lines should share their prosperity and carry the burdens of the weaker and unprofitable lines.

The problem of consolidation lies in the safeguarding of the interests of the investor in already profitable lines, and also in the maintenance of efficient service in territory now served by profitable lines, without detracting from this service by the added burden.

With this situation in mind, do you favor voluntary consolidation, compulsory consolidation, or the present individual freedom of action?

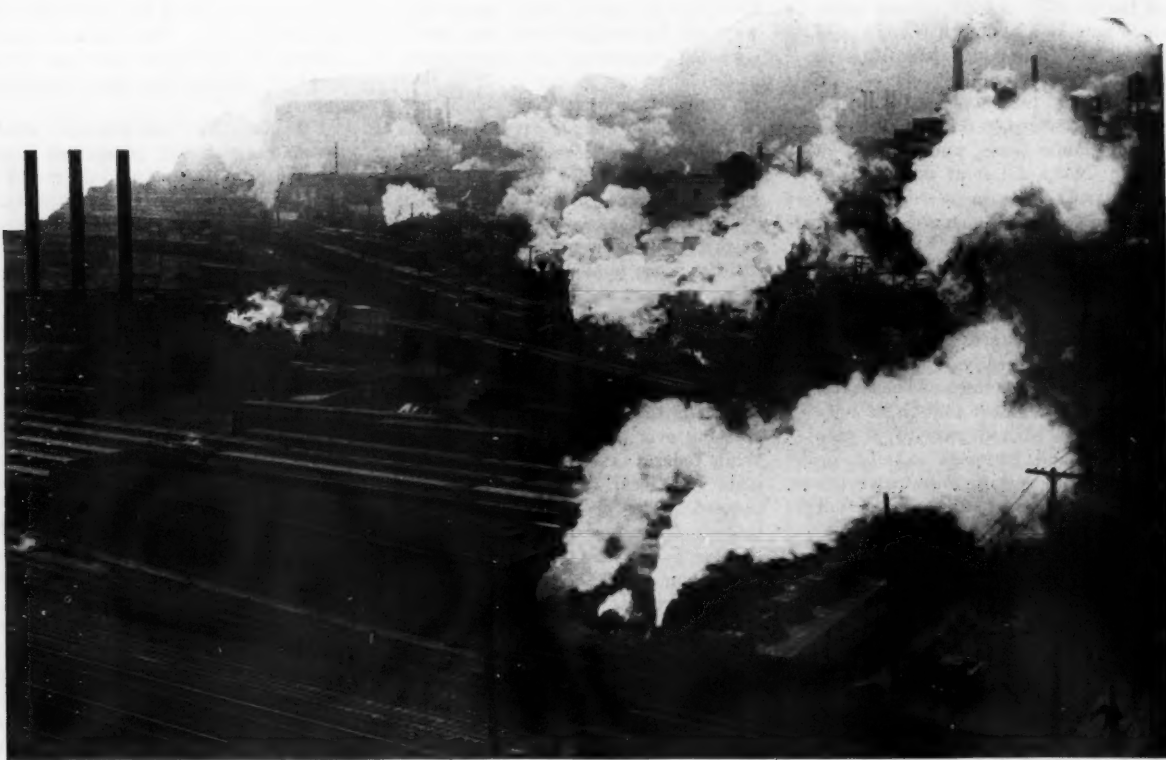
Replies to this group were as follows:

Economists and tax experts.....	52%
National associations.....	52%
Professional men.....	52%
Miscellaneous men and women in public life.....	50%
Editors.....	48%
Bankers.....	36%
Producers of raw materials.....	34%
Wholesalers.....	34%
Transportation heads.....	30%
Manufacturers.....	28%

Voluntary consolidation was favored by 73 percent of the total replies.

Compulsory consolidation approved by 7 percent, and 20 percent of all replies said they had no opinion in the matter.

It is confidently believed that this symposium represents a true cross section of American opinion on these problems. No (Continued on page 589)



Underwood & Underwood

RAILROAD CONSOLIDATION*

Voluntary Consolidation Favored By A Large Majority—Effect Upon Freight Rate Reductions Doubtful—Increased Efficiency And Reduced Overhead Desirable—"Individual Freedom Of Action" Now Exists Only In Theory

ELSEWHERE in this issue will be found a symposium on national problems submitted to a selected and representative list of 500 leaders of thought and industry.

Upon the question of railroad consolidation, the general consensus of opinion is that the so-called present "individual freedom of action" is already greatly curtailed.

One writer says, "The present Federal law permits acquisition—through lease or stock ownership, *provided the Interstate Commerce Commission approves*. Grouping under the present law has very onerous provisions. As a result, consolidation has not been promoted, but hindered. The policy of consolidation—declared by Congress in the transportation act to be in the public interest—needs to be modified in order that the consolidation policy may be realized."

Another says, "Any consolidation policy to be successful and practicable, must be of permissive and not of a compulsory character."

* This article is a resumé prepared from the information gathered by the Bureau of Mining Economics, The American Mining Congress, on five major national questions.

Attention was particularly directed by several respondents to the fact that under the present plan of accomplishing consolidations by purchase of securities of the several lines, nothing but a transfer of ownership is achieved, and the real object, a physical merger, with single operating, accounting, and traffic heads, does not result.

One theory, stressed by the President and others, that economies of consolidation would permit reduction in rates is questioned by some, advanced by others. That it might result in many cases of absolute freedom of action, and voluntary grouping, is the general opinion.

Commissioner Eastman, as chairman of the Interstate Commerce Commission and presenting the majority of views of that body before the Senate Committee on Interstate Commerce last year, disposed of that idea when he said:

"The country ought not to be led into the belief that great consolidations of railway properties involve any probability that the general level of freight rates may thereby be substantially reduced."

One executive states that while theo-

retically, consolidation of railroads will eliminate the weak lines, the theory is fraught with dangerous consequences when reduced to facts, since in the first place no sure plan has yet been brought forward which would insure a legal compulsory consolidation of a strong and successful road with one which enjoys none of the advantages of the other; and in the second place, there is no assurance that such a combination would bring the weak road to a higher standard. It is possible and highly probable instead, that it will serve to pull down the credit of a stronger railroad and hamper its development, and in that way reduce the quality of the service it is now giving its patrons.

A successful mechanical engineer writes, "Railroads were built to meet a demand, and if the demand no longer exists, they should be abandoned just as any other business is dropped when it does not pay."

"Supervised initiative," which will reward service and operating efficiency, and will preserve reasonable competition and existing trade routes, sums up the

expression of a number of professional men.

One large national association advises that there should be no hesitancy about scrapping an unprofitable line, unless it would deprive a considerable population of essential service; in which latter case, no consolidation of surrounding lines should be approved unless it includes the weaker line.

Another national group believes that the fundamental laws of economics are opposed to guaranteeing investment returns by law, and favors compulsory consolidation, based on adequate service regardless of cost.

The editorial group is strongly opposed to anything but the utmost freedom of action. One editor says that compulsory consolidation would find owners joining with employees and all of them yelling for government ownership. The Government would then take the roads over and the taxpayer would foot the deficit.

One suggestion is made that the weaker lines should start operating trucks and buses and abandon present rights-of-way and equipment, or else motorize present rolling-stock.

A considerable number deplore the power already in the hands of the Interstate Commerce Commission, which gives it arbitrary control of branch line extensions, etc. It is stated that the railroads owe first consideration to their stockholders (altruism notwithstanding), and that whenever stockholders are benefitted, the public is better served.

"Every socialist imagines that success should be penalized to support the less efficient and less prosperous. We consider the railroads public utilities and imagine they are owned by the public. This is not the case. They are public utilities, but they are owned by their stockholders. It is astonishing how many persons want to dance and even dictate the kind of dances, without paying one cent to ward paying the piper."

A member of the agricultural group believes that the highly profitable lines should share their prosperity and help carry the burden of the weaker lines. He believes that the same plan rises here that applies to the keeping up of rural schools with a division of tax money derived from towns and cities! As the rural sections in a great measure are accountable for the accumulation of property in towns and cities, which in turn are taxed for the maintenance of rural schools, so the big railroads being fed by the weaker lines serving a territory that can not be abandoned, should

contribute toward their operation.

Opposed to this attitude is a prominent wholesaler who says, "The doctrine that the rich should pay for the poor," is damnably unjust in any form of business.

A banker states that the railroads were never so efficiently managed as at present, and have never before rendered more satisfactory service to the public. He concludes, "The public would be better off if legislation on railroad matters were adjourned indefinitely."

Another says that conditions in the transportation industry, anticipated by the framers of the 1920 act, did not materialize, and there is no longer any need for demanding consolidations.

One economist says that subdivisible power, like the internal combustion engine and electricity, will eventually break our railroads into smaller operative units rather than larger; while another says that any form of consolidation should take into account not only the interests of the owners of both the strong and weak roads, but should also safeguard the interests of the productive areas and markets involved.

It will thus be seen, that throughout the whole gamut of expression, is the underlying thought that individual initiative and entire freedom of action are indicated for the continued progress of our great transportation systems, whose present achievements, voluntarily accomplished, are admired and studied by other nations.

Considerable divergence of opinion appears as to the actual powers of the Interstate Commerce Commission, and the extent to which it may arrogate new duties and assume extraterritoriality. Certain it is, that following the tendency in Congress to extend its authority, the Commission has of late branched out into new fields. Criticism is also made that with the present lack of uniform geo-

graphical representation on the Commission, equitable solutions of many of its problems become increasingly difficult.

The possible effect of any movement toward consolidation, on existing rate structures, has brought out a number of theories and prophecies as to the ultimate course which will be chosen. There are some who see a gradual tendency toward mileage basis; others who believe that districting will follow grouping, and that cross-haul will pass into history.

Opposed to these is that school which teaches absolute freedom in the selection of both source of raw material and competitive markets. It is probable that with few exceptions, the limitations of manufacture are the price of transportation of raw material from its sources of production, and the cost of selling as controlled by the expense of its traveling salesmen, in the territory involved.

If a finished product in any manufacturing center has a limited zone of distribution it must also be the nucleus of a settled community and reasonably established selling costs. But its raw material must be brought from wherever it may be obtained. If distance is to be the sole governing factor in freight rates on raw material, this means that civilization must become peripatetic, following varying sources of raw material.

It would appear that the wiser course would be for us to allow capital to remain where it is, with a fixed and prosperous civilization in many manufacturing centers, and to fix such rates on the transportation of raw material as will best serve the producer, the consumer, and the transportation intermediary. All of which presupposes absolute freedom of action and natural and healthy competition, under such limited supervision as may be necessary only to prevent outstanding abuses and unwholesome discrimination.

NATIONAL PROBLEMS

(Continued from page 587)

effort was spared to secure a full and free expression by each respondent, all the questionnaires being keyed by number only, and the names selected being carefully held in confidence.

It will be noted that a fairly representative percentage of replies was received from each group, and that the third question on government ownership elicited a higher number of replies than any other.

On taxation and public land ownership a diversity of opinion and many theories were advanced, while on the remaining subjects no doubt remains as to the sentiment of the majority.



Henry Miller

TAXATION OF AMERICAN BUSINESS IN EUROPE

American Companies Doing Business In Europe Are Subjected To Double Taxation In Many Instances—Meetings Being Held Under League of Nations Auspices To Work Out Uniform Principles—Present Conditions Outlined

MUCH has been said recently of the tariff walls of Europe but many traders have been also troubled by the nets of taxation that they may fall into after the walls of customs duties have been surmounted. Every country has its tax net, each of a different weave, and some with meshes drawn so tightly that there is virtually no chance of escape.

In every state the tax system comprises both national and local taxes. The principal national tax is almost invariably an income tax, but the structure of this tax is different in every country. Additional resources for the central government are in many instances obtained through real estate taxes and through sales, stamp, and other indirect levies. While in some countries local taxes are imposed independently of the national levies, in others they consist in percentages that are levied on the basis of the national tax. In general, all systems theoretically tax the foreigner the same as nationals.

The simplest European system is the English income tax which has been in the process of development for more than a century, having been originally introduced as an extraordinary source of revenue to carry on the war against Napoleon. For administrative purposes income is classified under five schedules:

Schedule D is the one of primary interest to Americans because it deals with the annual profits or gains arising or accruing to any person residing in the United Kingdom, whether Britisher or foreigner, from any kind of property whatever, whether situate in the United Kingdom or elsewhere. It also pertains to the annual profits or gains accruing to any person, whether Britisher or foreigner, residing in the United Kingdom from any profession or trade carried on within or without the United Kingdom. A non-resident of the United Kingdom is taxable on income from property, or a trade, or profession exercised within the United Kingdom.

The standard rate of four shillings in the pound or 20 percent is payable by both individuals and corporations on all kinds of income treated under the various schedules. Individuals are allowed certain abatements under the standard rate and pay supertax on income exceeding £2,000 (\$10,000 in round numbers). The rates of the supertax are

By MITCHELL B. CARROLL *

graduated from 9 pence to six shillings in the pound, or from 3% to 30 percent. A corporation pays 20 percent on its net profits, then recoups itself by deducting 20 percent from the dividends distributed.

Returns are submitted annually to a local board of commissioners—prominent citizens in the community where the taxpayer resides—who nominally assess the tax. In practice, the assessment is usually made by an inspector in the office of the Collector of Inland Revenue and then approved by the local commissioners. Appeal against the assessment may be made either to the local commissioners, or to a board of special commissioners appointed by the Collector of Inland Revenue and subsequently to the courts.

The local taxes in England are called "rates" and vary from place to place. In the business centers of London they amount in all to about 10 percent of the rental value of the premises occupied.

AMERICANS IN GERMANY UNDER DAWES PLAN AND REICH TAX SYSTEM

All commercial concerns in Germany, including those belonging to foreigners, with a capital of more than 20,000 gold marks, must help pay the German reparations bill. The *Industriebelastungsgesetz* (Industrial Charges Law) of August 30, 1924, requires all industrial and trading concerns, including mines and maritime and inland shipping concerns, private railways, narrow gage railways and tramways, with a working capital exceeding 50,000 gold marks, to issue debentures representing a total nominal capital of 5,000,000,000 gold marks. During the second year of application of the Experts Plan—September 1, 1925 to August 31, 1926—an annuity of 125,000,000 gold marks, being interest at the rate of 2½ percent, on the total nominal capital, had to be paid. During the present or third year (1926-1927) the annuity will be 250,000,000 gold marks, representing interest at 5 percent. From the fourth year, it will be 300,000,000 gold marks representing interest at 5 percent and 1 percent amortization.

In order to equalize the charge imposed upon industry in Germany, the *Aufbringungsgesetz* (Law for the Production of the Industrial Charges) enlarges the number of concerns subject to the charge imposed by the *Industriebelastungsgesetz*, so as to include industrial

concerns as well as banking, insurance and all commercial concerns, and hotels, cafés and boarding houses, whose working capital exceeds 20,000 gold marks. The rate for the past year was 3.75 per thousand of the working capital, and the rate for the present year will be announced after January 1.

If an American buys real estate in Germany, he becomes subject to the *Reich Vermögensteuer* (property tax) on assessed value, the average rate being 5 per 1,000. The individual employed or carrying on business in Germany is subject to the *Einkommensteuer* (income tax), which is graduated from 10 to 40 percent on income exceeding 8,000 Reichs marks, after certain deductions for family charges in the case of small incomes. When salaries are paid, the employer deducts and pays to the state 10 percent for the account of the employee. Similarly, the company deducts for the state 10 percent from dividends when they are paid.

A special income tax, *Körperschaftsteuer*, is provided for corporations, the rate being 20 percent of the net profits. Reduced rates are granted a German private limited company (*G.m.b.H.*) with a capital not exceeding 50,000 Reichs marks.

The corporation submits a return at the close of its fiscal year and an assessment is made the following spring or fall, as the case may be. While waiting the assessment, the company makes provisional quarterly payments on the basis of the assessment for the preceding year. After the new assessment is issued, an adjustment is made.

Most of the states in Germany levy trading, real estate, and house rent taxes, and the municipalities impose supplementary rates.

FRENCH INCOME TAX MODELLED AFTER BRITISH AND GERMAN SYSTEMS

The French tax system was completely reorganized in 1914 on the basis of a bill proposed by Monsieur Cailloux. The new system is composed of seven scheduled taxes, which reflect the influence of the British schedules but differ in that various rates are applied: for example, lands, buildings, dividends and interest, 18 percent; commercial and industrial profits, 15 percent; income from non-commercial professions, salaries, and agricultural profits, 12 percent. Like the Prussian system, the general income tax applies to the entire income of a resident individual from all sources, but it

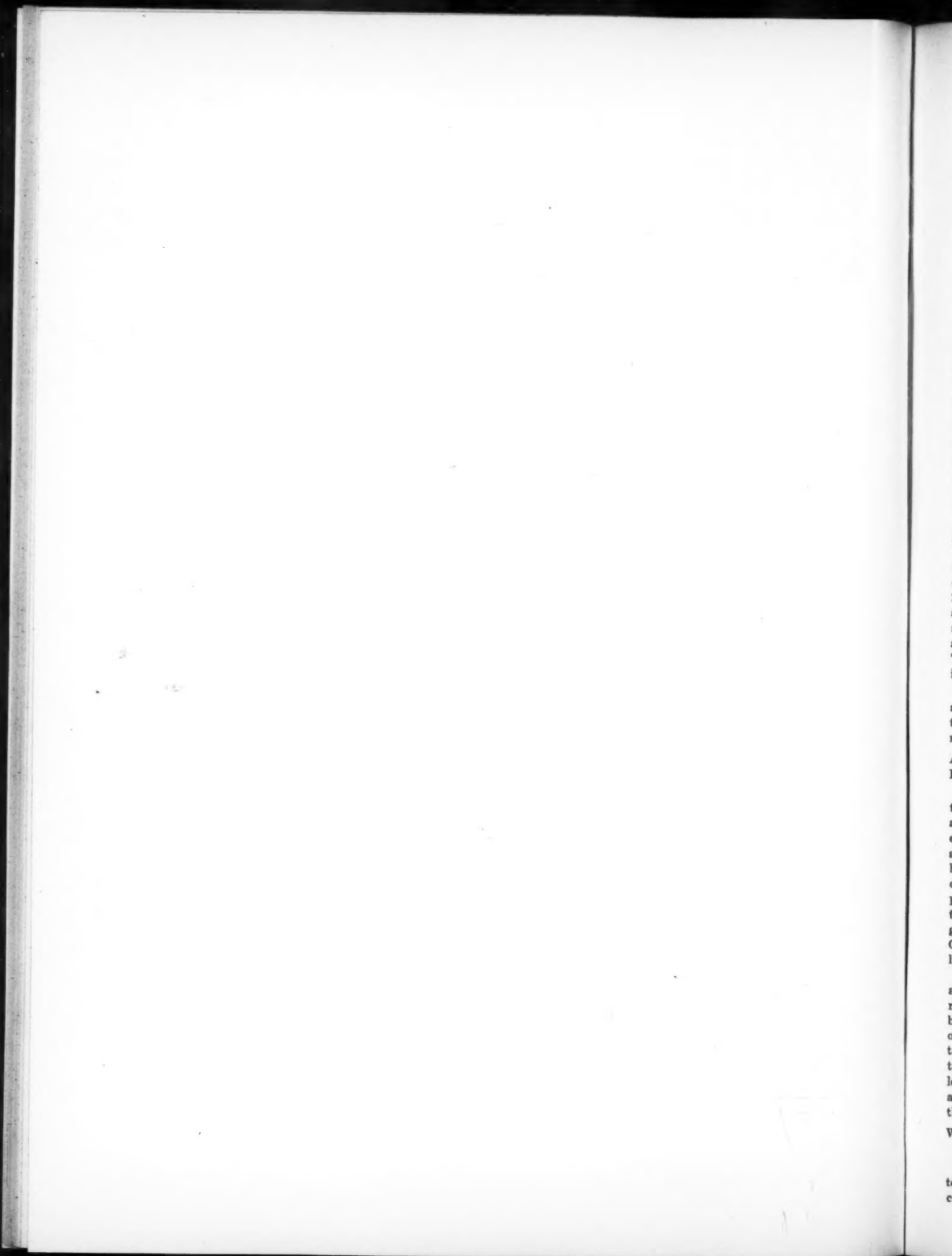
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Sycamore Island In The Potomac

© Harold Gray

"True beauty dwells in deep retreats"



is similar to the British supertax in that it is supplementary to the schedular levies. The rates of the general income tax are graduated from 1.2 percent on income between 7,000 and 20,000 francs to 30 percent on income exceeding 550,000 francs.

"Centimes additionnels" are imposed on the basis of certain national taxes for the benefit of the departments and communes.

The Belgian and Italian systems are similar in their broad outlines to the French. The Belgian system embraces a real estate tax of 11 percent, the "taxe mobilière" with rates varying according to the kind of income, the professional tax, graduated from 2 to 10 percent and the supertax on total revenues which progresses from 1 to 30 percent. The additional percentages levied for the benefit of the provinces and communes may increase the property tax to as much as 22 percent and the tax on invested capital to as much as 16 percent.

The Italian system embraces three schedular levies: income from lands, and buildings, each 10 percent; and from movable wealth, with rates varying according to the kind of income-interest 22 percent, corporations 16 percent, variable income from work, 14 percent, and salaries, 11 percent. Supplements are added for the provinces and communes. The surtax on income from all sources is graduated from 1 to 10 percent.

Italy has reorganized its system so as to favor business and reductions in the profits tax are to take effect in the next few years.

AUSTRIA, CZECHOSLOVAKIA AND HUNGARY HAVE SUBSTANTIALLY THE SAME SYSTEM

Although until recently all a part of the same empire, both Czechoslovakia and Hungary have diverged to a certain extent from the Austrian system. While all three countries have a land tax, a building tax, a general profits tax on individuals and partnerships, and a corporation tax, and certain other levies, the rates differ to an extraordinary degree. A bill has been introduced in the Czechoslovak Parliament with a view to lightening the taxes on business.

Spain is also in the process of revising and reducing taxes. Holland recently reduced the income tax on individuals by 20 percent. After the high rates of other European countries have been taken into consideration, one is relieved to hear that in Holland the profits of a locally organized company are only taxable when distributed as dividends, at the rate of 9.05 percent.

WHEN AN INDIVIDUAL BECOMES LIABLE TO TAXES

All European countries welcome the tourist and impose no taxes on him except in an indirect manner, as is fre-

quently evidenced by the stamps affixed to his hotel bill. The commercial traveler seldom encounters in fact any liability to income tax so long as he keeps moving and does not establish a residence in any particular place. A number of the smaller European countries, however, require them to pay certain license fees. In England liability to income tax depends upon residence, which is a pure question of fact. A foreign visitor is exempt provided that: (a) he is in England for some temporary purpose only, (b) he is not in that country with a view to establishing his residence therein, and (c) he shall not reside in the United Kingdom for six months, in the aggregate, during any one financial year. In a recent case, a business man took pains to be outside of England for more than six months every year but he always returned to England and carried on his business there during the other months over a period of years. The British court held that he was a resident of the United Kingdom and therefore taxable.

In Germany, an individual becomes liable to the income tax on revenues from all sources if he has there his domicile or his residence for more than six months. If a person remains in Germany for less than six months he is subject to taxation only on income proceeding from sources in the Reich.

One acquires a residence in Germany in such a manner as to become totally liable to German income tax, if he merely leases a dwelling place and maintains it continuously at his disposal whether he occupies it or not. In a recent case, an American leased a house on the Rhine with a view to occupying it only during the summer months but he enjoyed the entire disposition of it for a period of years. Although he became technically liable to taxation on his total income, the German Finance Ministry had the power to reach an agreement with him whereby he would be taxed on a more equitable basis.

The French schedular taxes being imposed on income from French sources are not so difficult to impose, but in order to subject the numerous foreigners who spend the better part of their time in the enjoyment of French resorts, to the general income tax, a very ingenious method has been adopted. Realizing the impossibility of checking up the foreign sources of income flowing to a rich foreigner leasing a sumptuous apartment on, for example, the Champs Elysees, the tax authorities arbitrarily assess him on the basis of seven times the rent paid for the apartment. If, however, it is shown that his real income is greater than this amount, he will be taxed on the basis of actual revenues.

In most other countries a foreigner becomes liable to income tax after a

year's residence, although he is always liable in respect to income proceeding from property, and in some cases from stocks and bonds, whether he is resident or not.

WHAT CONSTITUTES DOING BUSINESS IN FOREIGN COUNTRIES

In practically all of the European countries, the concept of what constitutes doing business is substantially the same as that which prevails in interstate commerce in the United States. In all of the income tax laws is found the principle that profits arising from trade carried on within the country are taxable. Trade is carried on within the particular country whenever the foreign concern has either a sales agency or branch, a factory, an assembling plant, or some other kind of business establishment operating under its name. In any country, a foreign company is liable if it sells its products in a sales office bearing the company's name on the door or through some other establishment that is admittedly operating for the profit of the company.

In order to observe just where liability commences, it is necessary to study the various methods of marketing products in a foreign country. In general, they are the following:

1. Direct sale to customer.
2. Direct sale to an importing merchant.
3. Direct sale under an agency agreement to a leader or distributor who buys and resells for his own account but under the conditions of the contract with the exporter.
4. Indirect sale through commission agent or broker.
5. Indirect sale through a local agent who solicits or takes orders subject to the acceptance of the American company, the goods being shipped direct to the purchaser.
6. Indirect sale through a local agent who sells out of a consigned stock and is remunerated on a commission basis.
7. Establishment of a sales agency or branch.
8. Organization of a local company.

In general, business done with a foreign country by direct sales is tax exempt, while business done within a foreign country by sales made by an agent in the strict sense or a branch operating under the company's name is taxable. When goods are marketed by means of selling to a locally established company which in turn resells them, the subsidiary company will be taxed on the same basis as any other local company of a similar kind, and the parent company will in most instances be taxed on the dividend it receives.

The most troublesome point in the international tax law is in determining

whether a foreign company is doing business through an independent commission agent or broker or through an agent in the strict sense. More graphically, the line of demarcation between non-liability and liability lies somewhere between the indirect sale through general commission agent or broker and that through a local agent selling out of a consigned stock.

Inasmuch as this question has been given particular attention in the jurisprudence of British courts, a study of the situation in the United Kingdom gives an idea of the refinement of legal reasoning in this respect. The Income Tax Act of 1918 declares foreigners taxable on business done through agents in the United Kingdom. (General Rules 5 to 14.) This provision envisages the agent in the strict legal sense, that is to say the individual or firm doing business for the account of a foreign principal. So strictly was this provision construed in a number of decisions that the large entrepot trade carried on by commission agents and brokers was seriously threatened. With a view to protecting this kind of business, a provision was inserted in the Finance Act of 1925, Section 17, exempting the profits of transactions carried out on behalf of a non-resident person or company by a bona fide broker or commission agent in the ordinary course of his business as such and receiving the customary remuneration, even though such intermediary acts regularly for the non-resident. In short, sales made through a bona fide broker are non-taxable while those made through an agent in the narrow sense are taxable.

Unfortunately, it is impossible to give a succinct definition of a bona fide broker or commission agent. The English courts have decided under specific groups of facts that in one instance a broker is involved while in another a pure agency relationship exists. So long as the broker merely serves as the intermediary to bring buyer and seller together and then withdraws from the transaction no liability is entailed. Similarly, the foreign exporter who sends a consignment of some bulk commodity to a regularly established commission house doing business for any number of foreign firms, does not incur taxation if the commission house in the ordinary course of business disposes of the shipment to third parties and remits the proceeds to the foreign principal. If the commission agent or broker does acts without the ordinary course of his business, such as advertising, or making unusual efforts to solicit orders for the benefit of the foreign firm, or in given certain discretionary powers over the goods or proceeds that are generally granted only to agents in the strict sense, it is very likely that the

foreign firm will be regarded as doing business in the United Kingdom through an agent and will be assessed in the latter's name.

Formerly, the British authorities observed a fairly simple formula in determining whether a foreign firm was taxable on profits made in the United Kingdom. Three elements were considered:

1. Where the contract was made.
2. Where delivery was made, and
3. Where payment was made.

If all three occurred in Great Britain, the foreign firm was liable. If the contract was made in the United Kingdom but delivery and payment were made outside, the tendency was to tax the foreign firm. On the other hand, if the contract was made elsewhere and delivery and payment were made in the Kingdom, the chances favored the foreign firm. Little by little the courts arrived at the conclusion that the question of liability could not be solved by a simple formula but that each case should be determined according to its facts. In other words, the courts will look into the devious methods followed to circumvent the law rather than to the technical compliance with the law.

While formerly the authorities did not concern themselves with the apparently independent "agent" who merely solicited orders which were to be accepted by the foreign firm, the goods being shipped direct to the customer, they are now inclined to look behind the technicalities in order to ascertain if in fact a relationship of pure agency exists.

The German law on these points appears to be substantially the same as the English. The provision was inserted in the income and corporation tax laws of August 10, 1925, that foreign concerns would be taxable on profits made through permanent representatives (*ständige Vertreter*). This term "permanent representative" has been delimited to a certain degree. In the exchange of notes between the German and Swedish governments on December 31, 1925, it was agreed that the term did not include the representative who merely served as intermediary without being empowered to close transactions even though business was done through him regularly. In the ministerial instructions issued February 23, 1926, it was stated that commission agents, brokers, and other commercial intermediaries, who are registered in the commercial register as such, no longer be required to furnish information regarding the business of their foreign principals, provided they were not in a position to be regarded as the employee (*Angestellte*) of the foreign concern. These instructions were a temporary measure, intended merely to clarify the situation somewhat, and especially to protect the large commission agency bus-

iness in raw materials and foodstuffs in Germany's northern ports, until definite agreements on this point could be reached with other countries. As the situation apparently stands today, it is probably similar to that in Great Britain; business done through the regular commission agent or broker, representing any number of foreign firms, is not taxable, while that done through the permanent representative or agent in the strict sense is taxable. In other European countries the tendency of the law and practice seems to be along the same lines.

The terms "commission agent" and "broker" usually apply to the intermediary, remunerated by commissions, who deals on a large scale in bulk commodities for any number of firms. They do not include the so-called "agent" who makes retail sales for the account of a single exporter, out of a small stock of articles that are consigned to him, or warehoused in the name of the exporter or entrusted to a bank for delivery against payment. Under most European tax systems, the rule is found that stock plus agent equals liability; it being understood that the stock belongs to the principal and that the agent sells from it for the account of the principal. In strict law it is immaterial in determining the liability of the principal whether the stock is consigned to the agent himself or is maintained elsewhere, but at the disposal of the agent.

In connection with the delicate questions of liability just discussed, it may be said that although a foreign firm is technically liable to taxation, it does not necessarily follow that automatically an assessment will be made. Sometimes business may be carried on for a number of years under one of the doubtful methods without the tax authorities ever discovering the relationship. In other instances, the tax authorities will observe the business of the agent for a long period without intimating that they have any suspicion as to the liability of the foreign firm, and finally when they feel assured that agency in fact exists over a long period, they will assess the foreign firm for back taxes.

Most American firms that are doing business on a stable and permanent basis in European countries have found it advisable to take a clear cut position. In some instances they have found satisfactory firms that will serve as dealers or distributors in a certain area. Such firms buy outright from the American manufacturer, frequently paying cash against documents in New York, and sell at their own risk. A large majority of American exporters have found it preferable on the other hand, to have an establishment of their own in an important country. While in some instances it has been found satisfactory to simply

register a branch, in most cases experience has shown the advantage of organizing a local subsidiary company. One of the most important reasons for taking this step, has been that the determination of taxable profits, and in some instances, of taxable capital or property, is thereby greatly facilitated.

BRANCHES USUALLY TAXED LIKE LOCAL COMPANIES

The simplest way for an American company to sell its products abroad under its own name is to rent the necessary quarters, place its name on the door and commence business. However, in every country the foreign merchant is required by law to conform to certain registration requirements, and in some instances almost as many—if not more—formalities must be complied with as in forming a local company. Certain registration fees are payable, and in Germany the capital tax of 4 percent is imposed on the amount of capital invested in the branch enterprise.

In theory the foreign company is taxable only on the profits made by the branch, but very frequently disputes arise with the tax officials as to the actual amount of such profits. If the tax authorities are not satisfied with the returns based on the books of the branch, they generally require that the foreign company submit the balance sheet and profit and loss account covering the entire operations of the parent enterprise in all countries in order that they may determine to their own satisfaction the profits allocable to the branch.

In both England and Germany the profits of the sales agency of a foreign corporation are taxable at 20 percent. In France not only is the 15 percent tax on industrial and commercial profits leviable but the tax administration reaches out even to impose an 18 percent tax on the dividends declared by the corporation in the United States that represent the proportion of profits made in France. In order to guarantee this payment, the foreign company must conform to a large number of registration requirements of the tax administration and must name a French agent, usually a bank, who will be responsible for the payment of taxes due if the foreign company should default. Furthermore, within a reasonable time after business has been commenced, the parent company must submit its balance sheet and profit and loss account in order that the authorities may determine the proportion of business in France to total business on the basis of which the dividend tax will be imposed.

FORMATION OF LOCAL COMPANY USUALLY FACILITIES FIXING LIABILITY

If an American corporation establishes branches in a number of different countries, and each country requires the sub-

mission of accounts, showing the profits made in all countries, the inconveniences that may be thus entailed are obvious. In order to clearly segregate the profits allocable to a particular country, the foreign corporation frequently establishes a subsidiary company organized under the laws of the State in question.

The local company, being a distinct entity, will be taxed on the same basis as any similar native enterprise, unless there is a clear attempt to defraud the treasury by consistently showing no profits. In such an instance the tax authorities are usually empowered to tear aside the corporate veil and tax the parent company in the same manner as if the local enterprise were a branch.

In England a corporation pays 20 percent on its net profits, but recoups itself and passes the burden on to the shareholders by deducting 20 percent from distributed dividends. In Germany the corporation pays 20 percent for its own account and deducts an additional 10 percent for the account of the shareholder, remitting the latter amount to the Reich treasury. A French corporation pays 15 percent on its own profits and then deducts 18 percent from the dividends for the benefit of the state. This principle of stoppage-at-the-source prevents the escape of dividends to holders of bearer shares, who, if they are non-residents, frequently escape taxation entirely in certain other countries.

Under Italian law a corporation is taxed 16 percent by the central government, and under Austrian law, 25 percent, but dividends are only subject to the income tax in the hands of resident shareholders.

Interest on loans and bonds is frequently taxed at the source, the borrower deducting the appropriate tax and paying it over to the government. In order to encourage foreign loans, both Germany and Italy have authorized their finance ministries to exempt, under certain conditions the interest thereon from taxation.

MOST EUROPEAN COUNTRIES SEEKING TO ELIMINATE DOUBLE TAXATION

If a German corporation should establish a subsidiary company in France, before the profits made by the French company would reach the German shareholder, they would be subject first in France to the commercial profits tax of 15 percent and the dividend tax of 18 percent, and then in Germany to the corporation tax of 20 percent and the dividend tax of 10 percent. If a British corporation has a sales agency in Germany the profits of the latter are taxed 20 percent in Germany and another 20 percent when brought into the coffers of the British company.

The drain on profits resulting from heavy taxes being imposed both in the country where the income is produced and

in the country where the recipient resides has been almost great enough to discourage international trade. Many European countries have tried to solve this problem by concluding international agreements. In 1921, Austria, Hungary, Italy, Yugoslavia, Poland and Roumania signed a collective convention. Austria, France, Germany, Great Britain, Italy, Spain, Sweden and Switzerland have each been parties to bilateral agreements.

The German-Italian convention of October 31, 1925, is fairly typical of the arrangement favored on the continent. Income is classified, and it is stipulated which kind will be taxed in the country where it arises and which will be levied upon in the hands of the recipient. For example, under the German-Italian agreement, a German corporation having a branch in Italy will be taxed in Italy alone at the rate of 16 percent on the profits of the branch, and in Germany, 20 percent on the other profits realized in the Reich. Dividends are taxable at the domicile of the shareholder.

In the preceding arrangement the principles of taxing at the origin and taxing at the residence are both recognized. The agreement regarding double income tax concluded between the United Kingdom and the Irish Free State, April 14, 1926, adopts exclusively the principle of residence. An individual resident or a corporation controlled in London, for example, will be subject only to the English income tax no matter what kinds of income proceed from Irish sources. This system is regarded as the one most favorable to creditor countries. Interest paid on money loaned abroad will be subject to taxation only in the country where the lender resides. This is regarded by many authorities as the only practical method of taxing international loans, inasmuch as if a tax is imposed by the borrowing country, almost invariably it will be thrown back on the borrower. The lender stipulates very frequently that he shall receive a certain rate of interest free of tax.

Since 1920 both the International Chamber of Commerce and the League of Nations have been engaged separately and cooperatively, through their respective committees on double taxation, in trying to find a uniform method of eliminating this heavy burden on international trade and finance. In April, 1923, four well known economists, one of them being Professor Seligman, of Columbia University, submitted a report to the League regarding the economic consequences of double taxation. In February, 1925, the League published the resolutions of a group of technical experts which were based on the report of the economists and embodied principles for eliminating double taxation of the various kinds of income. In June, 1925, a committee, headed by Professor T. S. (Continued on page 620)

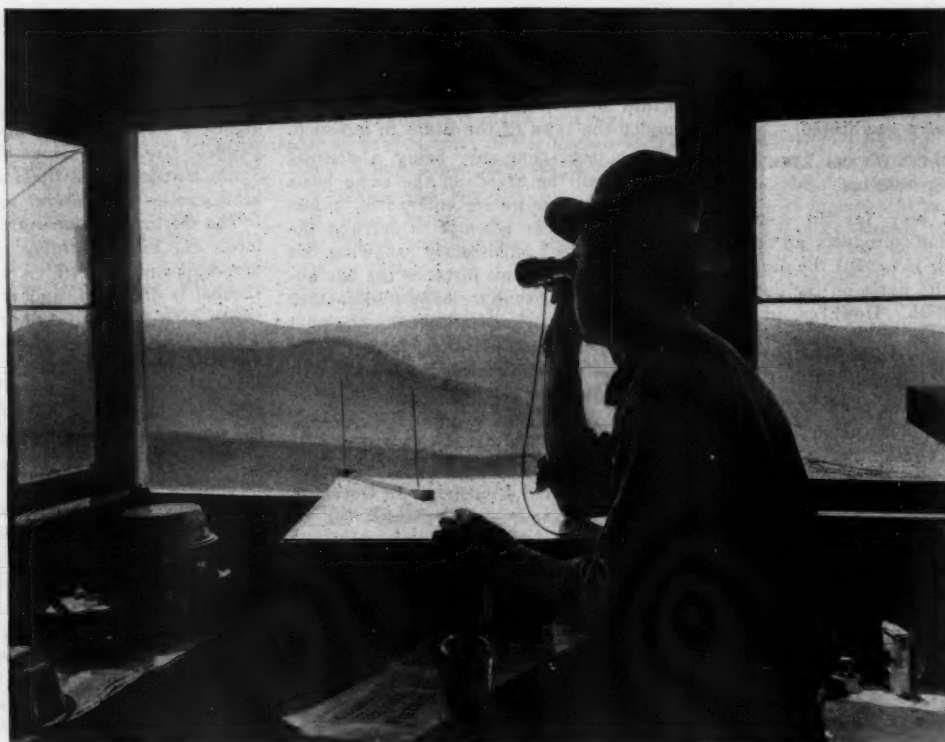


Photo by T. P. Lukens.
Forest Fire Lookout in the Tahoe National Forest, California

SHALL THE NATIONAL FORESTS BE ABOLISHED

Forest Service Replies To Gilmore Articles—Mistakenly Imagined That Issue Involved Is One Of Subordination Of Western Interests To Those Of East—Fundamental Question Is Will West Be Best Served By Maintaining Or By Abandoning National Forests

THE MINING CONGRESS JOURNAL has, in five successive issues, presented under the title "Federal Domination Versus State Sovereignty" the views of a contributor who opposes continued national ownership and protection of western forests. Editorially THE JOURNAL has stated: "The policy of the federal government in relation to the disposition of public lands in the western states should be no different from that which prevailed while the central states and middle western states were being developed, and where practically all of the original public domain has passed to private ownership and is now subject to state and local taxation." The withholding of areas of public lands from private ownership is regarded by THE JOURNAL as discrimination against the western states. "The general question of state rights in the public domain must be determined at an early date in the

By WILLIAM B. GREELEY *

(Photographs courtesy U. S. Forest Service)

interest of the western states, as well as the whole country," concludes THE JOURNAL editorial.

Advocacy of turning over the present national forests to the states is by no means confined to THE JOURNAL. Last winter the state of Wyoming memorialized Congress on the subject of the public lands. That memorial asked Congress to "enact such legislation as will cause the return by the United States to the states comprising said government of all vacant and unappropriated land, together with all natural resources, including water power, power sites, forests, and minerals now held in such by the federal government within the borders of any of the said states." Prior to the receipt of that memorial Congressman Winter, of Wyoming, said on the floor of Congress:

"A crisis is near in regard to our public lands and the destiny of the public land states. * * * A final policy must soon be determined by Congress as to the vital and tremendous question of the ultimate disposition of all the lands not now privately owned, unreserved and reserved, comprising vast bodies of land within 11 states of this Union."

Congressman Winter said further in the same speech:

"Why can not states administer the forest areas within their boundaries as well as the federal government? * * * Our states should have the right to develop the untold mineral resources which undoubtedly lie in the forest areas, as well as the annual growth of timber. * * * It may not be soon, but I look for the day to come when, following the original plan of this Union, pursuing the American form of government, the states will come not only into their jurisdiction as now over the forest lands for pur-

* Chief Forester, United States Forest Service.



Photo by Wallace Hutchinson.
Heavy stand of timber on the Lassen
National Forest, California



Photo by W. J. Lubken.
Cattle grazing on the Montezuma
National Forest, Colorado

poses of government, the preservation of law and order, the advancement of education, but, as a natural and rightful corollary with that responsibility, into full ownership and control."

Throughout the United States the interest of the public in forestry, and the recognition of the need to promote reforestation and bring about right methods of land use on the nearly one-fourth of our total land area which has highest value for forest purposes, is more pronounced than ever before. Many of the older states, which have seen their forest resources progressively dissipated under private ownership, and which are now feeling the full force of the economic consequences that follow depletion of the timber resources—the migration of industries and population, the drop in taxable values, the bankruptcy of counties, the decline in rural prosperity, and the incubus of mounting areas of idle lands—are seeking means to bring back the forests. They are faced with very heavy expenditures to remedy the mistakes of the past, and with the prospect of many long years of waiting, at best, before their vanished forest wealth can be restored and the land that has been stripped of its timber can return to productivity. A policy of state and federal purchases of eastern forest land, once in public ownership, to bring it back at heavy public cost to timber growing where private enterprise finds the task too burdensome is being initiated. Yet coincident with all this, a formidable movement is developing for undoing what the nation has undertaken in the West, to prevent a repetition of the mistakes formerly made in the east, with such harmful and painful consequences.

THE REAL ISSUE

It is mistakenly imagined in some quarters that the issue involved is one of federal domination versus state sovereignty; or of a subordination of the interests of the West to those of the East; or of absentee landlordism with

Uncle Sam playing the role of landlord; or of the blocking of local developments; or of the curtailment of local sources of public revenue through the withholding of land from taxation. It is none of these. The fundamental question is whether the best interests of the West will be served by maintaining or by abandoning the national forest enterprise.

Much has been made in the series of articles which THE MINING CONGRESS JOURNAL has published of the question of the constitutionality of the national forests. Similarly, the writer of the article has challenged the constitutionality of the legislation empowering the Secretary of Agriculture to make rules and regulations having the force and effect of law. All this is misdirected. The Constitution itself makes the Supreme Court its interpreter. The question of the constitutionality of the laws under which the national forests were created and are administered has been fully and repeatedly presented to the Supreme Court. Its rendered decisions have become the law of the land. The proper place for further argument of these questions, if further argument is deemed necessary, is before the courts, which are entirely competent to distinguish between sound and erroneous legal reasoning. The question for the public to decide is whether the national forests are a good thing or a bad thing. If they are a bad thing, it is not necessary to go to the courts in order to get rid of them. Congress has full power. It can repeal or modify its own laws whenever and to the extent that the public welfare requires.

States' rights, for a long time regarded by most people as a dead issue, has of late become again a political shibboleth. We are in a period of almost hysterical reaction against government. "Bureaucracy" has become a catchword. Since, as THE MINING CONGRESS JOURNAL has admirably pointed out, the federal

executive government is necessarily a government of bureaus and could not function except through these agencies, in current discussion "bureaucracy" generally signifies "federal bureaucracy," and is attacked as inimical both to states' rights and to individual rights. Those who would like to see the national forests abolished, for one reason or another, obviously and naturally suppose that they can make headway by constructing a syllogism like this: Federal bureaucracy is hateful; the national forests are necessarily administered by a federal bureau; therefore the national forests are hateful.

Or like this: The powers of the federal government have been extended to the detriment of the states; the national forests are an extension of the federal power; therefore the national forests should be abolished.

But the vital question is, Should they?

The attention of the whole country is now turned to the problem of flood control on the lower Mississippi. For half a century the people of the southern states adjoining the Mississippi have contended that the problem of flood control should be recognized as national in character and that the task of control should be assumed by the federal government. It has taken the overwhelming calamity of this year's flood to bring general assent to their contention. Will the assumption by the federal government of the task of flood control constitute an encroachment upon states' rights? Will the conduct of the work by a federal bureau or bureaus enlarge the iniquity and increase the hatefulness of federal bureaucracy?

A LITTLE PUBLIC LANDS HISTORY

About 1840 Arkansas and Missouri began to memorialize Congress on the subject of the swamp lands of the public domain lying within their territory. They asked that Congress take measures for the reclamation of these lands by the federal government or else, if the matter were to be left to the states, give them the land as partial compensation

for the expense involved. In 1849 a bill was before Congress to grant to Arkansas all the unsold swamp and overflowed land in the state, "to enable her to construct the necessary levees and drains." This bill, broadened to apply to all states containing such lands, was enacted in 1850.

Under the swamp lands grant Arkansas has received over seven and one-half million acres; Louisiana, nearly nine and one-half million acres; Mississippi, three and one-half million acres; Missouri, more than three and one-third million acres. Altogether, under that law of 1850 over 63,000,000 acres of public lands passed to the states. But where are the public works which these lands were intended to provide? And which was the wiser viewpoint—that of 1850, when it was held that the spirit of our institutions and our form of economic organization made it advisable for the federal government to turn over the swamp lands to the states along the lower Mississippi and to tell those states to wrestle with the problem of drainage and flood control themselves, or the viewpoint of the present time that flood control is a national problem?

WHAT BECAME OF FLORIDA'S SWAMP LANDS

Florida received more than 20,000,000 acres of public lands under the swamp lands act. The act itself expressly stipulated that "the proceeds of said lands, whether from sale or by direct appropriation in kind, shall be applied exclusively, as far as necessary, to the reclaiming said lands, by means of levees and drains." According to the Bureau of Corporations of the United States Department of Commerce, prior to January 1, 1911, Florida disposed of nearly 19,000,000 acres of the lands so received. Railroad companies had then received approximately 8,800,000 acres; canal and drainage companies, approximately 2,800,000 acres; a single individual purchaser, 4,000,000 acres, sold in the 80's at 25 cents an acre with use of the proceeds to meet interest on defaulted railroad bonds guaranteed by the state; 550,000 acres to the state land agents; other persons, 2,700,000 acres.

In 1908 the general council of the trustees of the internal improvement fund of the state of Florida summarized the accomplishment of the state in securing drainage and reclamation through disposal of the swamp lands as (a) approximately 90 miles of unsuccessful drains and canals constructed, and (b) temporary or partial drainage of not exceeding 100,000 acres of land. In the main the swamp lands having valuable stands of timber passed eventually into the hands of large timber companies and are now cut-over lands in need of reforestation, while the state is initiating a

new project for financing drainage operations in the Everglades through a large bond issue.

COULD THE PUBLIC LANDS STATES ADMINISTER THE NATIONAL FORESTS?

The public land states can not take over the management of the national forests. They are not equipped to do so. Successful permanent administration of land resources of the kind afforded by the national forests is a most difficult public undertaking. It is a highly technical task, requiring experience, skill, and an organization that will not become the football and can not become the tool

case was different. It was at that time, and in connection with the national forests' rights was reborn. And at that time, too, those who wished the national forests abolished in order that their timber, water-power sites, cattle and sheep ranges, and other resources might become private property urged that the West was being unfairly treated and that its interests were being subordinated to those of the East. Such views, though specious, had a far greater plausibility then than now. For the proof of the pudding is in the eating; and the people of the West now know quite well, through practical experience, that the national forests are not a form of absentee landlordism, or of landlordism of any kind, but that the national forests are a form of public utility, administered primarily for and primarily benefiting most of the interests of local communities and the local public.

THE NATIONAL FORESTS SERVE THE WEST

What does it mean to Maine or Georgia, in comparison with what it means to Wyoming or Utah, that the timber supplies and water resources within the national forests of the public land states are safeguarded for all time? Is it eastern lumbermen who cut the timber, eastern farmers who use the water, eastern wage earners, storekeepers, towns that benefit from the industries supported by the western forests?

Thirteen thousand national forest timber-sale contracts are current. Their manufactured output has easily a value of \$30,000,000 a year. Do citizens of New York or Illinois get the money? There are 29,000 grazing permittees. Do they live in the east? Their flocks and herds, it is true, help to feed and clothe the nation; but the profits, the wages, the state and county taxes coming from a national forest livestock industry with an annual production approximating \$75,000,000 contributed not to the welfare of Massachusetts or Louisiana but to the welfare of the public land states. Fifteen thousand people have summer home permits in the national forests and nearly as many millions avail themselves of the recreation opportunities which these public forests hold open to all citizens without charge; but they are chiefly western people.

THE EAST HELPS PAY THE BILL

That the East is milking the West through the national forests is a figment of the imagination. The East helps foot the bills; or, more accurately, contributes yearly to the national investment which is being made in these resources. It does more. The receipts from the national forests are fairly near, though still



Harris & Ewing

William B. Greeley

of partisan politics. It involves interstate interests in the control of stream-flow and the supply of water for irrigation and other purposes. It can be handled far more economically and far more efficiently under a unified policy and a unified organization, making available the best expert knowledge and the resources of the federal government for the solution of the great problems involved, than it could through a multitude of state organizations of divergent policies and each with its own overhead. To break it up would be as unwise as would be a requirement that our great transportation and industrial corporations should be broken up into units independent of each other and each required to operate within the boundaries of a single state only. The American people will not adopt such a course for the national forests.

Twenty years ago, when the national forest system was new and untried, the

below, their normal operating expenses. But because the national forests are not subject to taxation one-fourth of the receipts are returned to the states in which the forests lie, for the benefit of county school and road funds. Thus not only all improvement and development work but more than one-fourth of the actual operating cost is contributed by the general taxpayer. And the general taxpayer must foot the bills for emergency fire fighting, for all investigative work, and for timber planting.

Road construction is the outstanding improvement item. Its community value is almost incalculable. The total expenditure of federal appropriations for road and trail construction or improvement and maintenance, mainly in the public land states, within or on account of the national forests, to date exceeds \$61,000,000. The yearly outlay for this purpose alone is equivalent to approximately 6 cents per acre of national forest land. Is it easterners who mainly use these roads?

THE BUREAUCRACY FABLE

It is asserted that the Forest Service is an oppressive and uncontrolled bureaucracy. The assertion is untrue. Had the Forest Service not been responsive to local needs, had it not been doing a work of which the West approved and which the West wanted to have go on, it would have been thrown into the discard long ago—it and the whole national forest system. It received from Congress broad powers, because in no other way could the task of administration and protection of the vast and varied resources entrusted to it possibly have been performed. Congress could not enact minute laws adapted to fit a vast variety of conditions and contingencies. The national forests are a great business enterprise; and no great business enterprise can be conducted by legislative fiat and hard and fast prescription. Congress therefore told the Secretary of Agriculture to "make such rules and regulations and establish such service as will insure the objects of such reservations." The Forest Service has accepted the responsibility so conferred by Congress. It has been accountable to the President, to Congress, and to the public for everything that it has done. It is so accountable today. Had it refused to assume the responsibility with

which it was entrusted—had it failed to exert itself to the utmost to make the national forests serve the public welfare in every possible way and in the largest possible degree—then indeed it would have been guilty of bureaucracy; for instead of carrying out the will and the law of Congress it would have brought the law to naught.

THE INTERESTS OF THE MINING INDUSTRY ADVANCED

The relationship of the national forest system to the best interests of the mining industry should not be overlooked. From the beginning an important part of the function performed by the national forests has been to further the interests of that industry. Far from having interfered with mining development, it has rendered and is rendering the industry great service. By maintaining continuous supplies of timber always available for mining needs and by protecting and maintaining water supplies it insures two essentials of mining development and operation. By holding great areas of land in public ownership and open freely to mineral discovery and exploration, and

to the operation of the mining laws when valid discoveries of minerals are made, it gives the prospector a chance and a field which, if the lands were private property, would be entirely closed to him. On the other hand, by the barriers which it raises against the patenting of fraudulent mining claims it affords very material protection to the industry against one of its worst scourges—the fake mining company organized not to work claims but to fleece investors by selling worthless stock.

In the early days of the national forests the impression prevailed, both amongst mining men and with a large part of the general public, that the administrative methods of the Forest Service handicapped mining development. The service was widely and severely criticized on the ground that mining claims were examined and reports adverse to the claims were frequently made to the Department of the Interior, which passes on the validity of all claims, by forest officers incompetent to act as mineral examiners and report correctly whether or not the requirements of the law had been complied with. To provide a means

for running down all cases affording a ground for protest that the Forest Service was not giving mining men a fair deal, or was interfering with mineral discovery and mining development, a grievance committee was created by The American Mining Congress. This was done with the full approval of the Forest Service, which promised its hearty cooperation to the end that any cases of incompetence in dealing with claims, or of an antagonistic attitude toward mining interests, or of unnecessary and burdensome regulations might be brought to light and proper measures of correction applied. In order that wherever causes for complaint existed they might be brought before the committee, the widest publicity was given to the fact that the committee had formed and was prepared to function. Practically nothing of importance, however, has ever been presented for the committee to act upon. The Forest Service is today, as always prepared and anxious to cooperate with mining men, and with their organizations everywhere, in order that the best interest of their great industry and of the public generally may be furthered to the utmost.



Photo by E. S. Schipp.

View along Rattlesnake River, Missoula

REPORTS ON THE MECHANIZATION SURVEY

Four Conveyor Mining Operations In Modified Room And Pillar Systems—Different Methods Of Pillar Recovery—Shaking and Chain Conveyors

By G. B. SOUTHWARD

THE four reports which are here submitted—Nos. 111, 418, 610 and 623—show successful applications of conveyors to room and pillar mining. In these operations the haulage entries are developed by hand loading into mine cars and the conveyors are restricted to room advancement and pillar recovery. No. 610 uses a shaker loading attachment on the end of the conveyors which eliminates or reduces to a large extent hand shoveling while the other three use hand shoveling entirely to load the conveyors. Some changes from standard room and pillar practices have been made in those operations, as it has been found that conveyor mining can not be directly substituted for hand loading into mine cars without changing to some extent the general method of working. Since the advantages of conveyor mining are considered to result from easier loading conditions, higher gathering efficiency, greater concentration of workings and increased coal recovery, it may be well to consider whether and to what extent these advantages apply in these four operations described.

In each of these mines the conveyors used are a low type and it is obvious that a miner can shovel a greater tonnage onto these conveyors than he can into mine cars. However, other work is required as part of the loading operation, such as moving the face conveyor forward, extending haulage conveyors, timbering, drilling and shooting. In each of the reports submitted the number of men regularly employed to perform these operations is shown under the paragraph "Operating Crew" and the amount of work done in each shift is described with the average tonnage produced. The most conclusive manner of determining whether or not these operations are being performed more economically than by loading into mine cars would be to show a comparison of the mining costs. But mining costs are confidential and figures of this nature can not be published. However, from these reports the average tonnage and the men employed for the conveyor operations—from the face to the gathering side track—is shown for both high and low coal and a comparison can be approximated with the labor which, under ordinary and similar conditions, would be required for the same operations and for the same tonnage in hand loading with mine cars.

The extent to which the gathering haulage is simplified may be observed from the sketches and from the descriptions under the paragraph "Mechanical

Operation." In all of these mines a trip of cars is placed at the conveyor discharge point and in no case is a full gathering locomotive crew employed for a full time to serve a conveyor. In No. 111 no gathering locomotive is used at all as the trips are placed directly by the main line locomotive. The haulage conveyors which are used from the working face to the mine car loading point may be said to correspond to a gathering operation and any direct saving made by reducing or eliminating the gathering haulage would be offset to some extent by the labor required for installing and maintaining these haulage conveyors. When it is understood, however, that this

It is stated by men who are operating conveyors successfully, that this method of mining offers several possible advantages and opportunities for economies over hand shoveling into mine cars. These advantages are said to be increased tonnage per loader, higher efficiency in gathering transportation, less mine upkeep and higher coal recovery, and are based on the following claims:

"A low type conveyor can be loaded by hand shoveling with less labor than is required for shoveling into a comparatively high mine car.

"A conveyor laid along a room face or a pillar slab allows several men to load in one working place and this simplifies the gathering haulage by having a trip of cars placed and loaded at one point.

"By working the loaders in groups the number of places required for a given tonnage is reduced and the mine workings are concentrated into a smaller area requiring less maintenance and upkeep.

"By concentrating the mining area the rate of coal extraction will be increased and a better roof action and a higher coal recovery will result."

Without attempting to prove or disprove any of these claims, as applying generally, this article is submitting four operations which are reported by their managements to have effected marked economies over their present and previous operations by hand loading into mine cars.

has been taken into account there is no reason for not accepting the statements made by the managements that a direct saving in the gathering cost is made.

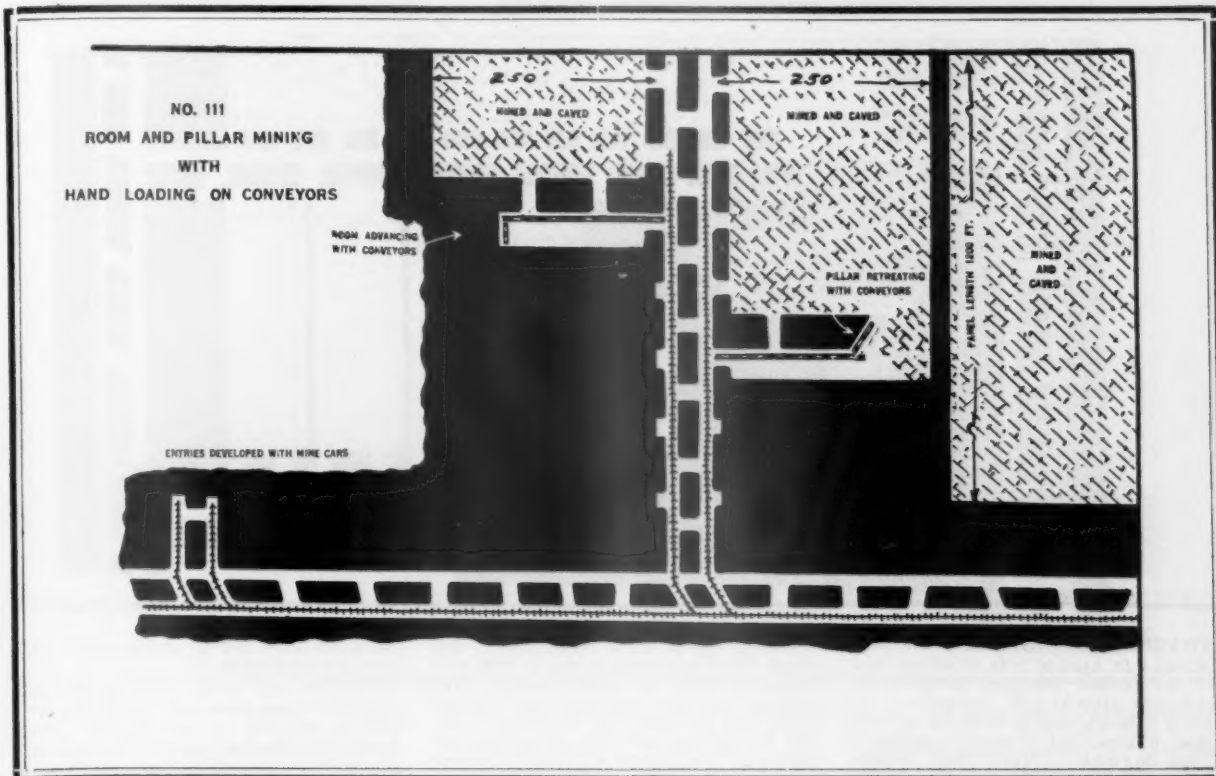
The first requirement of conveyor operation is that the work shall be concentrated into a small area where a sufficiently large tonnage can be produced to justify the expense of the installation and the operations shown here illustrate four methods of accomplishing this result. For example, in No. 111 only one room is worked as an operating unit but each room averages $2\frac{1}{2}$ clean ups per shift. Nos. 418 and 623 both take two rooms as an operating unit and average from $2\frac{1}{4}$ to 3 cuts during each shift. This applies to the two rooms. However, both of these operations work on double shift, loading during the day and night and average a clean-up of from $2\frac{1}{4}$ to 3 cuts in each room during each 24-hour period.

The claim that a high pillar recovery can be made in conveyor mining is well substantiated by the four operations here described and each one reports that a very small amount of coal is left unmined. In these operations four different methods of pillar recovery are used and may be summarized as follows:

No. 111 works a single room with a pillar between it and the gob and recovers this pillar open end. No. 418 works a pair of rooms which drive close to the gob and the pillar between the pair of rooms is mined by slab cuts parallel to the room length. No. 610 drives pairs of rooms at 150-foot intervals and recovers this 150-foot block by driving cross cuts through the block and recovering the remainder of the coal by widening the cross cuts with slab cuts on one or both sides. No. 623 drives cross cuts at 50-foot intervals through a 100-foot solid block of coal and a short face 100 feet long is started at each cross cut and works advancing to the gob.

It will be seen that these methods of pillar extraction do not differ radically from methods used in hand mining, so there is no apparent reason why a recovery should not be made which will at least equal that obtained in hand mining. Actually, the operations here illustrated present two distinct advantages over ordinary pillar mining. The first is that the pillars are being extracted close to solid coal and the second is that the rate of extraction is very rapid, taking in some instances two or three pillar cuts per shift.

Report No. 111



PHYSICAL CONDITIONS: Seam 46 in. high with no partings. Coal medium hard. Bone top with stratified slate above which stands up well over fairly large areas and breaks good in the pillar workings. Hard bottom. Seam generally flat, but has local rolls pitching 12 percent. Cover 250 to 300 ft. Open lights, entries rock dusted. Top is taken down for additional height along entries, but not in rooms.

MINING SYSTEM: Room and pillar retreating in panels 600 ft. wide by 1,200 ft. long. Developed by a pair of entries and worked by rooms 38 ft. wide and 250 ft. long, driven on 75-ft. centers to the right and left off the entry. Entry development and room necks are driven by hand loading with mine cars, rooms and pillars are mined by hand shoveling onto conveyors.

MECHANICAL OPERATION: Only two rooms are worked at one time in a panel—one off each entry—and as soon as a room has reached its limit the pillar is started back, working open end and angled slightly in toward the room. Each working face has three light portable conveyors, 13 ft. long with an independent motor drive; these are set in line parallel to the face and discharging from one to the other so as to form a conveying unit 36 ft. long. This unit discharges onto a haulage conveyor, set in the room and extending from the face to the entry where it discharges into mine cars on the haulway. This conveyor is sectional and is lengthened or shortened as the room advances or the pillar retreats. Mine cars of 2-ton capacity are delivered to the conveyor in 12-car trips by locomotive and are moved past the loading point in a solid trip by a rope hoist.

The coal in rooms and pillars is machine undercut 6 ft., drilled by electric hand drill and shot with permissible explosive and electric caps. Shots are spaced from 6 to 8 ft. apart and produce about 7 tons of coal per pound of explosive used. No regular slate picking is required.

TIMBERING AND ROOF ACTION: Wood posts, 6-in. diameter, are set on 6-ft. center in 6-ft. rows as the room advances and also as the pillar retreats, except that extra posts may be set when a roof fall is expected. Some timber is recovered, but not systematically or regularly, and no timbers are removed nor cribs built to cause or control a roof break. The roof falls occur at regular intervals and over fairly large areas, breaking from the back corner of the pillar across to the solid coal, generally leaving from one-half to three-fourths of the face open. A high pillar recovery is reported with very little interruption to the mining by roof falls.

OPERATING CREW: One room is taken as an operating unit and all work is done during the day shift of 8 hours by a regular crew of five men; one at the discharge end of the haulage conveyor to trim cars and operate the hoist, and four at the face who cut, drill, shoot, load, timber, and move the face conveyors. There is no regular task to be performed each day; three cuts are frequently loaded during a shift, but the average will be nearer two and a half cuts—each cut producing about 33 tons.

The face men work where required under the general direction of a "leader," and cutting, loading and timbering are carried on more or less simultaneously and continuously. The machine cutter

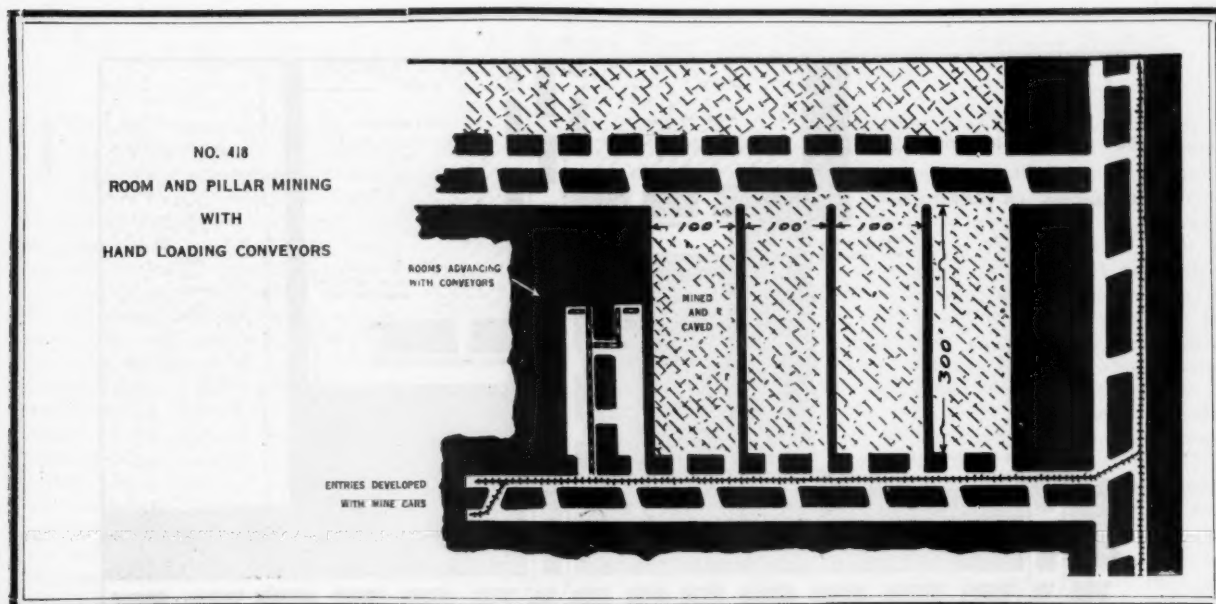
follows the loaders—cutting one-third of the face, then moving one of the three conveyors forward and setting timbers while loading on the remainder of the face continues. By the time a face is completely loaded out the cutting, drilling and timbering for the next cut is about completed and the face is ready to be shot down. Shots are fired one at a time, and as soon as the smoke has cleared the loading is resumed. The conveyors are set about 3 ft. from the coal before shooting; some coal falls on the conveyor, but most of it must be shoveled.

Besides the work of the regular loading crew, additional labor is used to extend and shorten the haulage conveyor, to move and reset the conveyors and rope hoist when a room and pillar is completed, and to deliver timbers to the face. There is, however, no gathering haulage required, as the main haulage locomotive delivers direct to the conveyor loading point; one locomotive serving three conveyor operations.

EQUIPMENT: Three face conveyors, each 13 ft. long, self-contained; one haulage conveyor, drag chain type, 300 ft. long; one undercutting machine; one electric hand drill; one blower fan with 12-in. canvas tubing; one rope hoist.

CONCLUSION: This conveyor mining system has been in use for about one year, including the experimental period, and has mined the equivalent of an area 250 ft. wide by 1,200 ft. long. It is now considered a successful operation and has concentrated the mining area and increased the production per man employed. No additional slate pickers are required on the tipples, and an increase of lump is reported possible by more careful shooting.

Report No. 418



PHYSICAL CONDITIONS: The seam is about 4 ft. high of soft structure coal, with no regular partings but with intermittent streaks of impurities. A shale top which stands well for a short period of time, but is hard to maintain in old workings. Hard clay bottom. Seam nearly level. Cover 450 to 700 ft. Closed lights. Rock dusting.

MINING SYSTEM: Room and pillar advancing with hand shoveling on conveyors in the room work and the pillar recovery. Entries are developed by hand loading into mine cars. The rooms are driven in pairs 350 ft. long, 40 ft. wide, with 20-ft. pillars between; only one pair of rooms is worked at a time in a panel, and as soon as they have driven through to the air course in the adjoining panel the pillar between them is mined back. A thin pillar of coal about 10 ft. wide is left between the gob and the next pair of rooms, since a more favorable roof action results when this pillar is left in than when a complete recovery of coal is attempted.

MECHANICAL OPERATION: In advancing a pair of rooms, a haulage conveyor is laid along the rib of one room extending from the entry to the room face and is lengthened each day as the room advances. A light portable conveyor is laid along the face of the room onto which the coal is hand shoveled; this face conveyor discharges onto the haulage conveyor. In the adjoining room the face conveyor discharges onto a short haulage conveyor which extends down that room to the last cross cut through which another light conveyor transports the coal to the haulage conveyor in the next room. When the pillars are being recovered both face conveyors are removed and the pillars are mined by slab cuts about 30 ft. long parallel to the room length and this coal is loaded onto the haulage conveyors.

The haulage conveyor discharges at the room neck into mine cars of 1½ tons capacity. These are placed in 25 to 30 car trips by a gathering locomotive and are moved past the conveyor

discharge point by a rope hoist. The track along the haulage way is laid with 30-pound steel on 36-in. gauge. The haulage and face conveyors and the coal drills are operated by compressed air, and the cutting machines, rope hoist and gathering locomotive by electric power.

Coal in the rooms and pillars is undercut by machine with a 6-ft. bar and is shot with permissible explosive and electric firing. A room generally uses five shots with one stick of powder in each shot.

TIMBERING AND ROOF ACTION: A row of wood posts from 3 to 5 in. in diameter is set after each cut with the posts on 4-ft. centers. This same general timber spacing is used in drawing pillars and no timbers are recovered; the posts are left in place until crushed by the roof. The falls occur at irregular intervals during the pillar work, but usually the roof can be supported on timbers while the coal is mined back for a distance of 50 to 60 ft. before the top caves. Under normal roof conditions, which generally prevail, a high recovery of the room pillars is reported.

OPERATING CREW: A pair of rooms is taken as a single operating unit and are worked by a regular crew of nine men, consisting of seven face men, one car trimmer, with a foreman supervising the operation. These men do the cutting, drilling, shooting, timbering and loading in both rooms, working where required and changing from one room to another under the direction of the foreman and performing all the operations continuously and more or less simultaneously during the shift. When a face is cleaned up, or nearly so, the cutting and timbering may be started, keeping one or two men to complete the clean-up and to load out the bug dust, while the remainder of the crew are shoveling in the adjoining room. Each face cut produces from 30 to 35 tons of coal and an average of 2½ room cuts is usually loaded out during each shift, the work being carried on two shifts of 8 hours each. When the pillar is being

extracted three 8-hour shifts of six men each are employed.

Timbers and other supplies are delivered to the room neck and are carried to the face by the regular crew. Besides the regular work of loading, etc., at the face, some additional labor is used for extending the compressed air lines and for general maintenance and repair of the equipment and also to move and reset the conveyors and rope hoist when a pair of rooms has been completed and the pillars drawn. There is, however, no continuous or full-time gathering haulage required, as the gathering locomotive, after placing a trip of cars at the conveyor discharge point, is used for serving other work near-by.

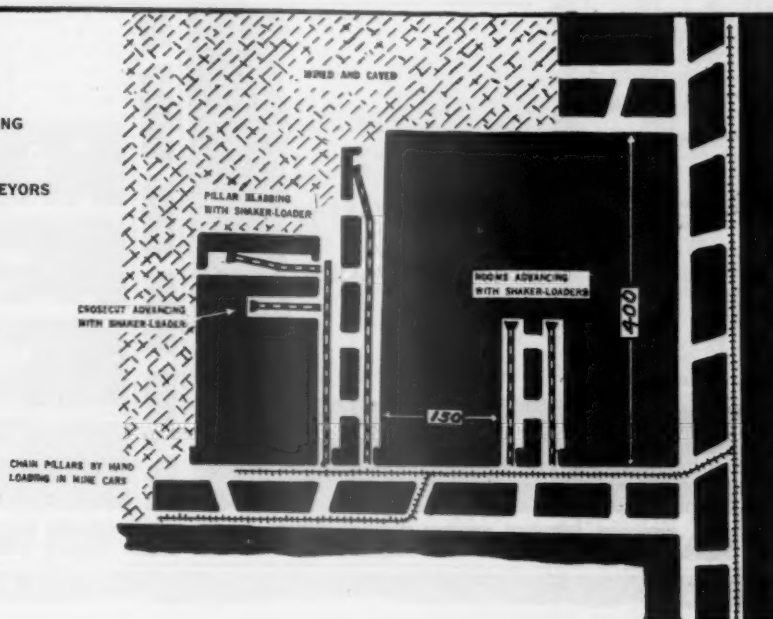
EQUIPMENT: Each pair of rooms uses one haulage conveyor—shaking type—330 ft. long when at its maximum length; two small drag-chain face conveyors 36 ft. long, two short cross conveyors—drag chain similar to face conveyors—each averaging about 50 ft. long, two undercutting machines, two rotary compressed air coal drills and one rope hoist.

PREPARATION: The coal has no regular parting, but has some occasional and irregular streaks of impurities. Handpicking is done along the faces, but the management has devised and installed a shaking screening arrangement in and near the discharge end of the shaking haulage conveyor which separates out the fine coal and provides a picking table where the larger sizes may be handpicked. This arrangement is still experimental, but the results attained so far have indicated its practicability.

CONCLUSION: This conveyor mining system has been in use for about six months and at the present time about 10 percent of the mine output is produced by conveyors. The management considers this operation to be economically successful and to have passed the experimental stage, and additional equipment for increasing the conveyor mining output is being installed.

Report No. 610

NO. 610
ROOM AND PILLAR MINING
WITH
SHAKER-LOADER AND CONVEYORS



PHYSICAL CONDITIONS: The seam is 8 ft. high of rather friable coal with no regular parting, but has an intermittent band of slate at times 2 in. thick. In the entries about 12 in. of coal is left for top which stands well, but in the rooms the entire seam is mined and the shale or slate top immediately above the coal is very heavy and difficult to support. The roof conditions in the rooms are very severe. Hard clay bottom. The seam pitches about 4 degrees. Cover 100 to 600 ft. Closed lights. Entries are rock dusted and sprinkling is used on the cutting machine bar.

MINING SYSTEM: Modified room and pillar retreating with a conveyor and shaker loader in the room advancement and the pillar recovery. Entries are developed by hand loading into mine cars.

Panels 400 ft. wide are developed by a pair of headings and pairs of rooms 24 ft. wide on 44-ft. centers are driven at right angles off the entry and through to the air course in the adjoining panel at 150-ft. intervals. As soon as a pair of rooms is driven out, a series of cross cuts—24 ft. wide on 44-ft. centers and starting at the top of the rooms—is turned off them at right angles, driving through the 150-ft. block to the area which has previously been mined out. The pillars between the cross cuts are recovered by slabs widening the cross cuts on one or both sides as roof conditions determine, and recovering as much of the pillar next to the gob area as conditions permit. A fairly high percentage of pillar recovery is reported. While one pillar is being recovered the next cross cut immediately below it is being driven.

MECHANICAL OPERATION: Shaking conveyors are used in the room advancement and on the pillar recovery; these conveyors have a loading attachment on the end which mechanically loads coal onto the conveyor by extending or advancing this loading attachment into the loose coal which has been shot

down. The last section of the conveyor is hinged so that the loading end may be swung across a room face.

A pair of rooms is taken as one operating unit, and two units—one advancing the rooms and one mining the cross cuts and pillars—are operated at one time in a panel.

As the rooms are advanced from the haulage entry the conveyor is extended, keeping the discharge point stationary in the room neck, and when the rooms are driven out, these conveyors are left in place and are used as haulage conveyors onto which the conveyors working the cross cuts and pillars discharge. In loading a slab cut along a pillar the conveyor is shortened so that the loading is started at the end of the face, and sections are added to lengthen the conveyor as the loading progresses.

The room conveyors discharge at the room neck into mine cars of 1½-ton capacity which are placed in eight-car trips by a gathering locomotive which moves the cars pass the discharge point while loading. A single track of 20-pound steel on 30-in. gauge is laid along the haulway.

Coal is undercut by machine with a 7-ft. bar and shot with permissible explosive and electric firing. Eight shots, four top and four bottom, are used in a room with two sticks of powder for each shot.

TIMBERING AND ROOF ACTION: In advancing the rooms and cross cuts, a cross bar with five posts is set after each cut. The roof weight is extremely heavy and in spite of this excessive timbering a majority of the posts and cross bars are broken by the weight before a room is completed. A few timbers are removed. A fairly high pillar recovery is reported.

OPERATING CREW: The mining is worked on two shifts of 8 hours each, and cutting, drilling, shooting, timbering and loading is carried in a continuous operation, each shift completing as

many cuts as possible. Each shift uses a crew of eight men—one man who operates the shaker loader, two hand shovelers, two timbermen, two cutting machine operators, who also do the drilling and shooting, and one gathering locomotive operator who trims the cars. An operating unit consists of two rooms, and while the loading operation is being done in one room or on one pillar, the cutting, timbering, etc., is carried on in the other, the men changing from place to place as required. Each room cut will produce about 45 tons, and during the last two months' operation each shift has averaged loading out from 2½ to 3 cuts.

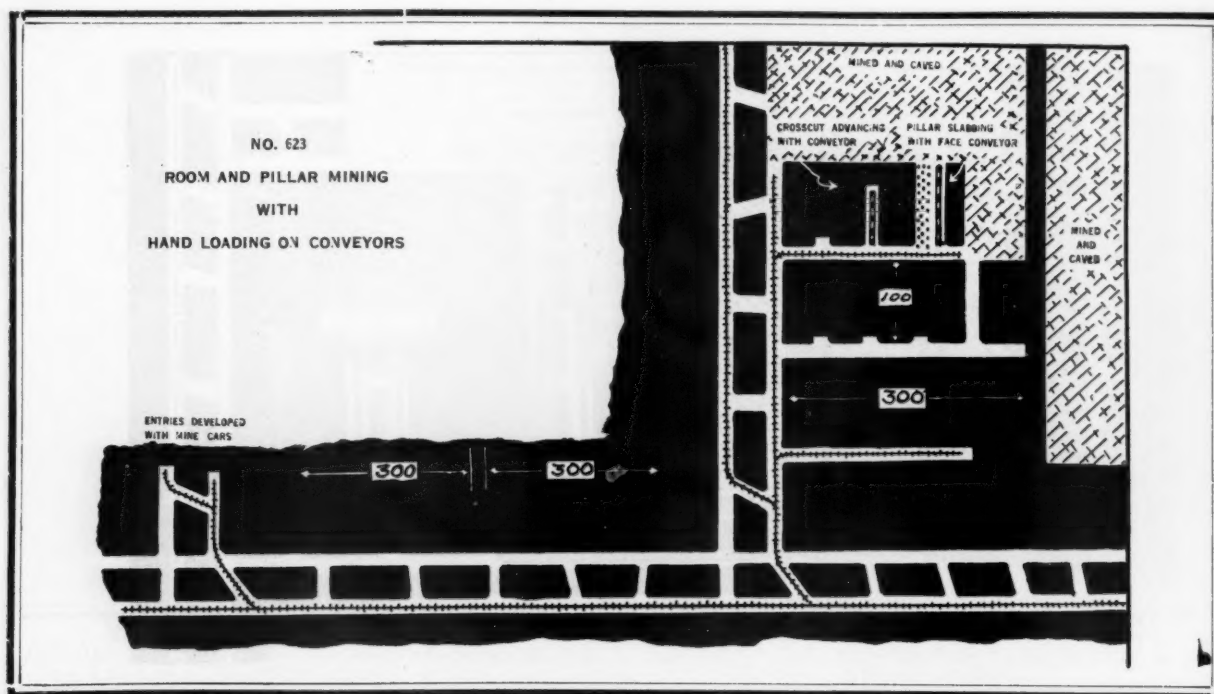
In addition to the regular work, extra labor is required for repair and maintenance and for removing and resetting the conveyors when a pair of rooms and pillars is completed.

EQUIPMENT: Each operating unit in one pair of rooms uses two shaker type conveyors—400 ft. long at their maximum length, two cross conveyors with a combined length of 250 ft., two shaker loading attachments, one electric hand drill, two cutting machines, one gathering locomotive, and one blower fan with canvas tubing.

PREPARATION: Very little slate picking is required and what is needed is done at the face. The management reports that the quality of the coal loaded by this method compares favorably with that loaded by hand and that a larger percentage of lump sizes is obtained than in hand mining.

CONCLUSION: This system and this equipment has been in operation for nearly a year and about 65 percent of the mine output is now loaded mechanically. The management reports the mechanical operation as successful and satisfactory in overcoming very severe roof conditions and shows a decided saving over hand loading methods within the same mine and under the same conditions.

Report No. 623



PHYSICAL CONDITIONS: The seam is 8 ft. high of medium hard coal with a parting near the center of bone or high ash coal about 6 in. in thickness. The roof conditions are variable; at times the top immediately over the coal is a sandstone, but a slate strata of varying thickness frequently occurs between the sandstone and the coal. Although some areas are encountered where this slate is difficult to hold, as a general thing it stands in the headings and rooms without excessive timbering and both the slate and the sandstone break fairly well in the pillar recovery. Immediately below the coal seam there is a hard bone strata 14 in. in thickness which is left unmined. The seam is generally level. Cover 400 to 500 ft. Closed lights. Entries rock dusted.

MINING SYSTEM: Modified room and pillar retreating with hand loading on face conveyors in the pillar recovery and entries driven by hand loading into mine cars.

A panel 600 ft. wide is developed by a pair of headings with single entries—or narrow rooms—turned off at right angles 100 ft. apart which develops the panel into blocks or pillars of coal 100 ft. wide by 300 ft. long. These blocks are mined by driving cross cuts 50 ft. apart through the block at right angles to the single entry and widening each cross cut by a slab or face 100 ft. long which works back from the cross cut toward the gob in the preceding mined area and continues until the gob line is reached. In the meantime, another cross cut 50 ft. below the first one has been driven through the block and a new face 100 ft. long is ready to be started there. Only one face is worked at one time on a block, starting the first face near the top of the entry and repeating its operation by successive cross cuts and

faces until the block has been mined out down to the headings. The blocks are mined one at a time and are worked off both the right and left sides of the pair of headings and the chain pillars along the entry are later recovered by hand loading into mine cars.

MECHANICAL OPERATION: A sectional conveyor 100 ft. long—assembled in three sections—is used on the face mining and to some extent in driving the cross cuts. Coal is shoveled by hand onto the conveyor which loads directly into mine cars at the end of the face on the single entry. The equipment is light and portable and is easily moved forward after a face has been loaded out and is disconnected in sections and carried by hand to a new location after an area has been completed.

In the single entry, a track of 25-pound steel on 36-in. gauge is extended up to the roof fall and mine cars of 2-ton capacity are placed in five-car trips at the discharge end of the face conveyor by a gathering locomotive and are dropped past the discharge point one at a time by hand. This gathering locomotive also serves other workings near-by.

The coal is undercut by machine with a 7-ft. bar and is shot by permissible explosive with electric firing. About eight holes are drilled along each face, using from two to three sticks of explosive for each shot.

TIMBERING AND ROOF ACTION: Two rows of posts from 6 to 7 in. diameter are set after each cut, placed about 3 ft. apart in each row. These posts are left in place supporting the top until a block of coal 100 ft. long has been mined out 50 ft. from a cross cut to the preceding gob line. The timbers are then removed as far as prac-

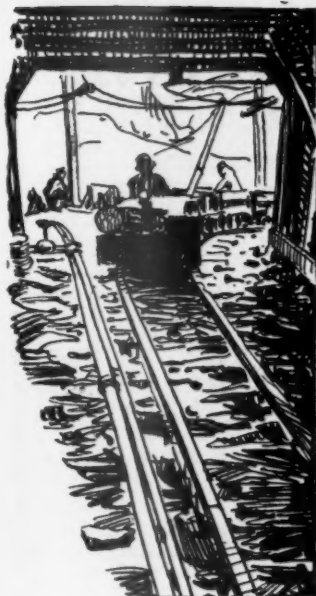
ticable and the roof caves. The experience had in mining by this system under these roof conditions has indicated that a face 100 ft. wide can be mined generally to a depth of 50 ft. before severe roof weight is encountered, and a high pillar recovery is reported.

OPERATING CREW: All work is done on the day shift of 8 hours and a crew of ten men is generally used; consisting of one foreman, one car trimmer, two timbermen, and six loaders. A face is usually loaded out once every two days, and on the third day the cutting, drilling and shooting is done and timbers are carried in for the next cut. On such days a part of the regular crew is employed driving the next cross cut 50 ft. below, and a machine crew of two men, outside of the regular face crew, makes a face cut in about 4 hours. Each face cut will produce from 180 to 200 tons.

PREPARATION: Some slate picking is done along the face, but picking tables on the tippie are used to insure a clean product. A high percentage of lump coal is not required at this operation, but the management reports that the percentage of sizes and the quality of the coal mined from the faces compares favorably with that produced by hand loading into mine cars.

EQUIPMENT: Each face operation uses 100 lineal feet of face conveyor—electric driven drag chain type—and one electric hand drill. The cutting machine and the gathering locomotive are both employed on other work and are not confined to the face operation.

CONCLUSION: This operation has been in use for nearly one year and the management reports that it has been demonstrated as a practicable system of mining under their physical conditions.



COAL

PRACTICAL OPERATING MEN'S DEPARTMENT

NEWELL G. ALFORD, Editor

*Practical Operating Problems of the
Coal Mining Industry*



STREAM POLLUTION THROUGH MINE DRAINAGE*

What Can Be Done In This General Mine Drainage Situation—A Coal Mine Not An Indefinitely Continuing Proposition—No Definite Formula For Treatment Of Acid Mine Water—Research Likely To Find Way Out

By HOWARD N. EAVENSON †

THE effect of mine and industrial wastes on streams is a serious question that has been, and is, troubling many communities and interests. In 1922 (and no later date is available) a committee of the American Waterworks Association presented a progress report showing that in the United States and Canada more than 250 water supplies have been affected by industrial wastes. The sources of contamination of 246 of these supplies were listed, divided as follows:

Kind of Wastes	Supplies affected	Pct. of total
Beet sugar and corn products refineries	4	1.6
Chemical manufacturing	10	4.0
Coal mining	107	43.6
Dyes	2	0.8
Gas and coke manufacturing	48	19.6
Gravel pit	1	0.4
Metal pickling and galvanizing	14	5.8
Mining—ore washing	3	1.2
Munitions manufacturing	3	1.2
Oil wells and refineries	16	6.5
Pulp and saw mills and wood products	22	8.9
Tanneries and leatherboard	8	3.2
Textile industries	4	1.6
Combined industrial wastes and sewage and miscellaneous	4	1.6
	246	100.0

* Paper presented before Annual Meeting, Isaac Walton League of America, Chicago, April 8, 1927, as representative of The National Coal Association.

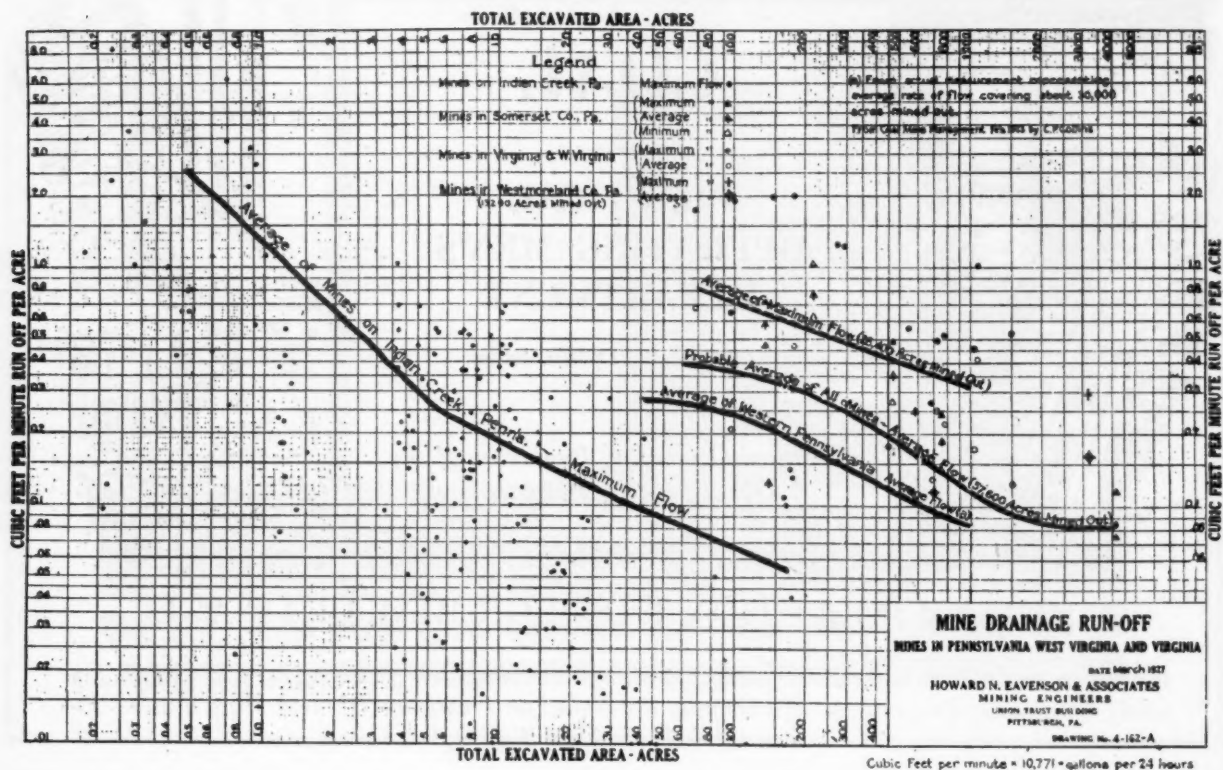
† Consulting Engineer, Howard N. Eavenson Associates, Pittsburgh, Pa.

Of the fourteen sources of drainage listed, that from coal mines is the largest single item in this list, and trouble from this source is due partly to fine coal carried from coal washers, but mainly to the acid found in nearly all mine waters. Water flowing in a mine, in presence of air, attacks the iron sulphide in the coal, and oxidizes it, forming iron sulphates and sulphuric acid. Part of the acid combines with calcium, aluminum and magnesium in the adjoining rocks, forming sulphates of those substances, but the remainder emerges as free acid. From the iron sulphates, by oxidation, ferrous and ferric hydrates are formed, which give the water greenish yellow or brown colors, and which, when deposited, discolor the banks and beds of streams. It is not known how much of this sulphur comes from the coal, or from the surrounding rocks, nor why in some cases the acidity of the drainage from mines in the same coal seam varies greatly in strength. It is a fact that usually acidity of the drainage from old mines is much higher than that from new ones, and the opinion of most min-

ing men is that this is due to the greater distance usually traveled by the water. The drainage from several of the largest mines in the Pittsburgh seam, however, three of which have been operating at least twenty-five years, is not at all acid, although the sulphur content of the coal is about the same as at other mines where the water is very strongly acid. Thus is apparent the local nature of the problem.

Mine water almost always comes through the overlying strata from the surface, and in the depths at which mining is now being done in this country, most of it comes through cracks opened in pillar withdrawals. Not many accurate data as to the amount of water handled are available, but most of this is shown on the accompanying chart, much of this being prepared for the Mountain Water Supply Co. v. Melcroft Coal Co. et al, case or the Indian Creek case, as it is called, and the remainder from the various sources noted. These data are for bituminous mines only, and conditions in the anthracite region are much different. From this it will be seen that the drainage per acre mined decreases as the area increases, as it also decreases as the thickness of cover increases. In most of the region covered by this chart there are more mines having an area of 500 acres, or over, than less than this amount (excluding the sporadic wagon mines), and this area may be taken as a fair average. The average drainage per acre for a 500-

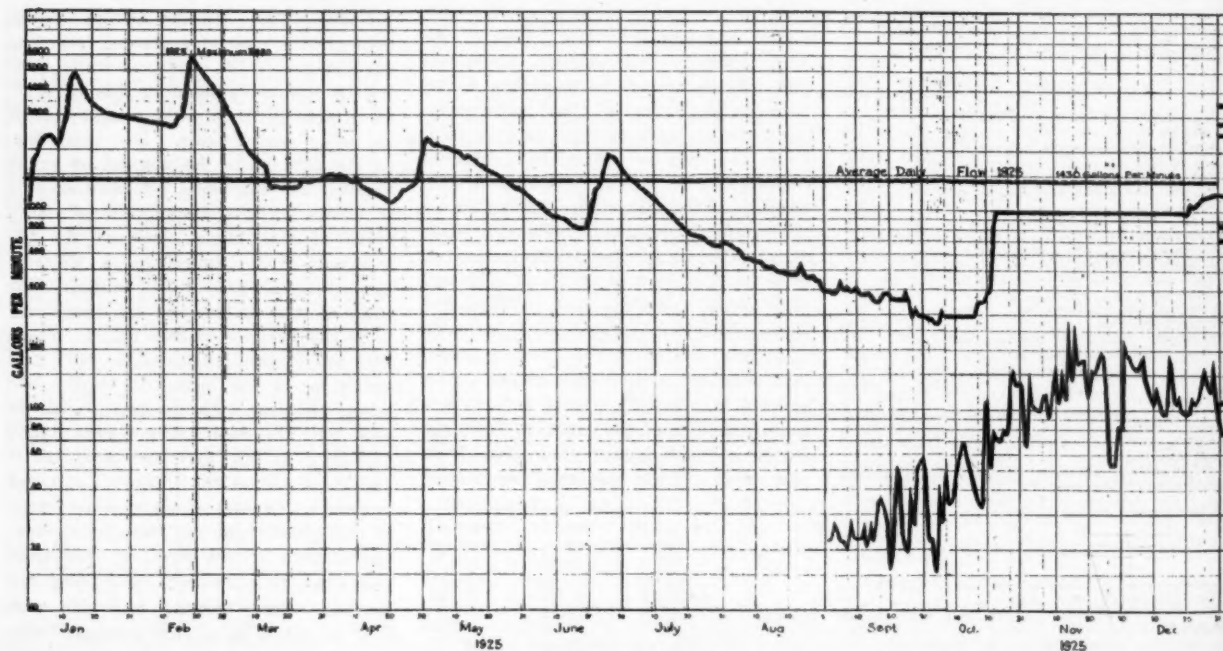
State	Original acres coal	Mined out to 1/1/26	Remaining acres coal 1/1/26
Pennsylvania—Bituminous only	7,762,150	670,630	7,091,520
Ohio—Pittsburgh seam only	1,273,500	100,550	1,172,950
West Virginia—Pittsburgh seam only, northern part of state	1,279,470	57,300	1,222,170
Maryland	43,670	35,830	7,840
Totals	10,358,790	864,310	9,494,480



acre area is 0.18 cu. ft. per minute, or 2,000 gallons per day, while the maximum run-off will be at least twice this amount. Chart 2 shows the daily mine flow of a mine in the lower measures in Fayette County, Pa., observation being made by weir measurements. With this are also plotted the flow of a mine in

southern West Virginia; readings are from a recording weir in a drainage heading, which handles the water from an excavated area of about 1,650 acres, including a mine which has been operating 45 years. Monthly flows from several other Pennsylvania mines are also shown. The Pennsylvania mine, which

we believe to be typical, and from which 193 acres have been excavated, shows a maximum daily flow of 302 percent of the yearly average; the West Virginia mine has a maximum flow for ten days of 472 percent of the yearly average. The monthly flow curves show that the average monthly flow will exceed the



average for the year by at least 50 percent and this fact must be considered in any discussion of the sizes of treatment plants required. While the latter case is typical of its locality, the overlying strata conditions are different from those in Pennsylvania, in the facts that the surface is much steeper, the soil is much thinner, and of a sandy type that will not silt up cracks as readily as the more clayey northern soils. This West Virginia mine shows a daily average run-off from 1926 of 2,157 gallons per acre excavated, with a maximum of 10,190 gallons per day per acre.

In a paper on "Mine Drainage Stream Pollution," before the American Institute of Mining and Metallurgical Engineers in 1923, various authorities in the anthracite region state that the average mine there pumps from 15 to 18 tons of water for each ton of coal produced, and that the daily mine drainage from the entire field is about 700,000,000 gallons, which is about the daily consumption of water of New York City. It is probable that this amount will increase with additional mining.

To obtain an idea of the magnitude of the problem to be solved, we will consider the experience of the states of Pennsylvania, Ohio, Maryland and the northern part of West Virginia carrying the Pittsburgh seam. Stream pollution is worse here than anywhere else, partly because in the anthracite region nearly all the coal is washed, partly because of the sulphur in some of the seams, and largely because of the age of the mines and the fact that the percentage of ex-

traction is more here than in most other fields.

Omitting for the present the anthracite region, there are, in the area mentioned, 10,358,790 acres of land carrying bituminous coal seams, of which about 864,310 acres have been mined. The figures† are shown in the chart on page 603.

Assuming the average rate of run-off above given, of 2,000 gallons per acre per day, we have a total amount of mine drainage in this area, almost all of which drains into the Ohio River, of 1,728,000,000 gallons per day. It must be remembered, however, that the average flow is much smaller than the maximum rate, so that the total quantity to be handled is much greater than the above, and for periods of a month about two and a half billion gallons per day must be handled. It is likely, however, that the drainage from the old mines decreases to some extent after they are abandoned, due to falls in pit mouth, etc., and to be conservative the smaller quantity may be considered as the amount of mine drainage in this area.

All of us know that almost any polluted water can be treated chemically and that most of the impurities can be removed, and the water be made fit for most uses, if expense need not be considered. Most, but not all, mine drainage is acid, and also contains acid sulphates, both of which corrode metal structures, and both of which can be removed from the water by chemical treatment, leaving the final effluent neither corrosive, injurious to fish life, nor liable to stain the streams, but not suitable for domestic purposes without dilution.

A number of agents can be used for this purpose theoretically, but practically, both for cost and convenience, only treatment with dry hydrated lime, fed mechanically to the water in proportions depending upon its acidity, can be considered. J. O. Handy, Director, Pittsburgh Testing Laboratory, who has had large experience with this subject, in a paper before the Cincinnati meeting of The American Mining Congress, in May, 1926, stated that "treatment" plants using this method will have an initial cost of about \$50,000 per 500,000 gallons treated per 24 hours, and that the operating cost will be about 15 cents per 1,000 gallons treated; that the coal mine water is not hardened, but is made slightly softer by this treatment, referring to the specific case of water treatment in the Indian Creek Valley, in Fayette County, Pa. About 6 pounds of dry hydrated lime are required, and from 7 to 12 pounds of iron oxide sludge are produced per 1,000 gallons of water treated. At present no market exists for any considerable amount of the iron oxide, although some uses for it will undoubtedly be found which will help to defray the costs of treatment, and the disposal of this iron oxide sludge, where it can not again enter the streams, is a serious problem.

Conditions vary so that it is difficult to give average figures; if treatment plants can be so located that one will serve an entire stream, the first cost may be lower than the amount stated, but if it is found necessary to thicken the sludge and to dry it to allow handling and conveying to storage, as it probably will be, the cost may be higher.

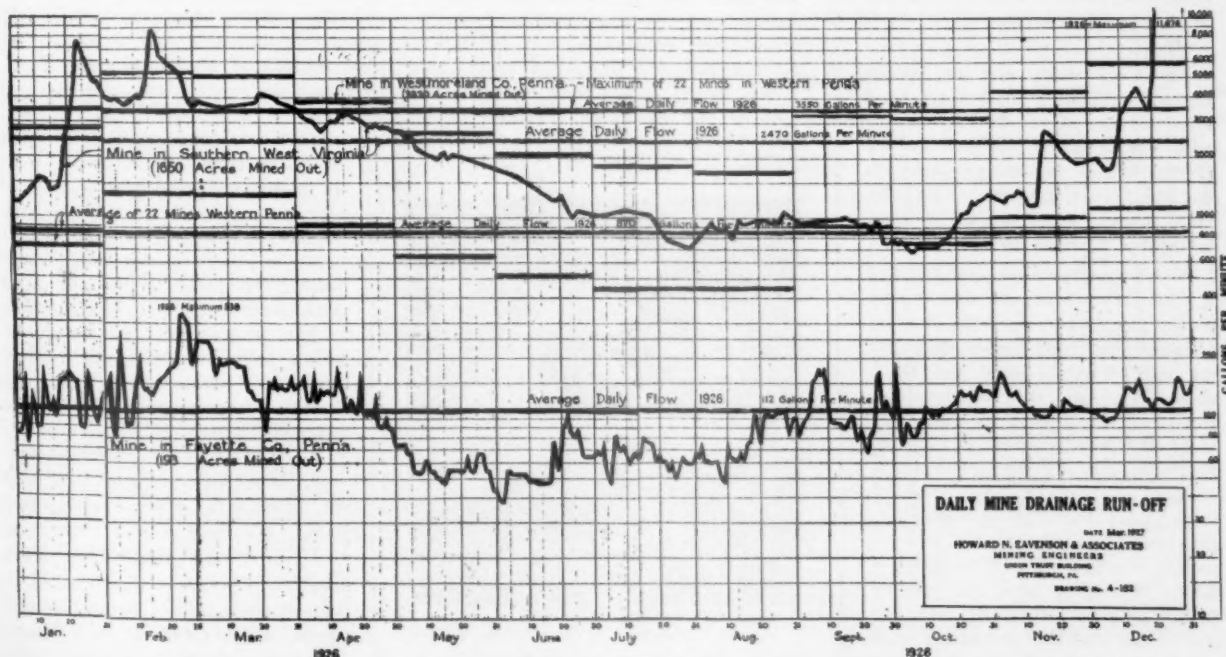


Chart No. 2 (part 2)

† Compiled from State Geological Survey Reports and original figures.

The figures both for first cost and operation, may be considered as reasonably accurate until more details of the problem are known.

For the amount of water to be handled in this area, the initial cost of treatment plants would be approximately \$172,000,000, and the annual cost of treatment would be approximately \$94,000,000, or for the minimum tonnage produced per year during the past 10 years, 60 cents per ton, and for the maximum output about 38 cents per ton.

For the anthracite region the cost of treatment would be about the same, and an approximate initial cost of \$70,000,000 would be required, and a cost of from 38 cents to 69 cents per ton produced, or an annual cost of about \$38,000,000.

The total cost of installing plants for treating all the acid mine drainage in the states of Pennsylvania, Maryland, Ohio and about half of West Virginia, would be approximately \$242,000,000, the annual cost of operation will be about \$132,000,000, or from 38 cents to 65 cents per ton of coal produced. It must be understood that a requirement of this sort will inevitably mean closing down some of the older and larger mines in this area, from which the drainage is much larger than the average amounts and is so great as to prevent their operation with this added cost.

The mine drainage problem is not so acute in other parts of the country as in this section, for the reasons already stated, but, based on the above data, for the entire country the initial cost of treatment plants would be approximately \$330,000,000, the annual operating expense \$180,000,000, and the cost per ton of coal produced from 35 cents to 42 cents.

For comparison, and not because it has any relation to the subject, the total annual value of all fish and fish products commercially produced in the United States, including Alaska, is \$96,880,000, which of course includes many sources which can not possibly be injured by mine water.

Also for comparison, and this has a vital relation to this matter, the income tax returns for 1924, the last available, for the States of Pennsylvania, West Virginia and Ohio, show a total of 1,919 coal companies reporting taxes in those states; of these 339 show a profit of \$28,934,927, and 1,580 a loss of \$56,249,263, or a net loss of \$27,314,336, or about .08 cent per ton. For the same year, for the entire country, 3,516 companies reported, of which 2,686 had losses making a total net loss of \$47,864,768, or about .08 cent per ton. Since that time conditions have not improved greatly, excepting for

the temporary boom in the coal market last fall caused by the English strike. It should be noted that not all coal producing companies return their earnings as such, although the great majority does.

Since 1913, when the present system of accounting was required by the income tax law, with the exception of the war years 1917 and 1918 and the post-war boom of 1920, there has not been a single year when this expense could have been borne by the coal industry and have left any profit.

The answer to this statement is, of course, that the consumer must pay the bill, as properly he should. This solution of the matter is not so easily arranged, however, because mine drainage from one state flows into other states, which may, or may not, have similar problems, and the imposition of this additional cost upon mines of one state which may not be able to pass the cost to the consumer, through competitive conditions, while it may help the water conditions in that area, will quite likely ruin the coal industry there at the same time. In illustration, the bituminous industry in western Pennsylvania, Ohio and northern West Virginia is now, and has been for several years, in a very precarious condition due to labor and freight rates, and intense competition with other fields; the imposition of this additional cost in that area would undoubtedly close all but a few of the more favorably situated commercial mines.

In considering the feasibility of treating acid mine water, Handy, in the paper already quoted, pertinently brings out the point that if the coal operator removes from the water coming from his mine those substances that pollute it, he has done his duty, and that water which finally comes from a coal plant alkaline, without color, corrosive power

or power to stain streams, and in which fish or vegetable life will live, should not be considered as mine drainage, but as purified coal mine water. This point was not definitely decided in the Indian Creek water case, as, while the Court finally enjoined the coal companies from "discharging, pumping or causing or permitting to flow or to be discharged, any drainage of mine waters from their mines," it is evident from the several mentions of "acid mine water" or "water contaminated by acid" in the decision that this is what was held to constitute the nuisance enjoined. In the Indian Creek case, however, the question involved was the prior right of a water company serving both domestic and industrial users.

Surely the discharge of water free from the impurities added in the mine can hardly be held to be a nuisance. It is impossible to treat acid mine water, without prohibitive expense, if at all, so that it will be suitable for all purposes without large dilution, and if the views as expressed by some water companies are to prevail in this requirement, the alternative is to stop mining coal, unless the regulation can be put into effect throughout the country at one time, and the public is willing to pay the bill, as the coal industry can not.

A coal mine is not an indefinitely continuing proposition, like a manufacturing proposition, and it can not be moved, like the latter can. When the coal has all been mined from any property, coal ceases coming from the openings, but water does not. Its volume probably diminishes, although this is not definitely known, and it may possibly be further reduced by sealing up the pit mouths. While this may reduce the amount of oxidation and, therefore, the acid content of the water, due to the decreased air supply, few operating coal men are of the opinion that it is possible to absolutely prevent the flow of water from an abandoned mine. In many instances the sealing of the opening to an abandoned mine would be fraught with danger. I refer to drift mines with large worked out areas. If the mine filled with water and the barricade or dam at the opening ever weakened, the valley below would be devastated. Thorough sealing with drainage facilities would obviate the danger referred to and might lessen oxidation and the resultant acidulous content. If so, and that were done with all abandoned mines, that would bring some improvement. When the coal has been exhausted, the state must be prepared to eventually handle the water from abandoned mines, as it must at once handle that (Continued on page 616)

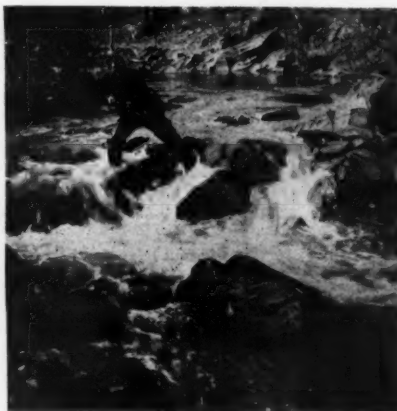


Photo by Talbott Denmead,
Deputy Chief U. S. Game Warden



METALS

PRACTICAL OPERATING MEN'S DEPARTMENT

GUY N. BJORGE, Editor

*Practical Operating Problems of the
Metal Mining Industry*



LEAD AND ZINC IN ARIZONA

Arizona's First Modern Lead Smelter, Just Being Completed By The Phelps Dodge Corporation, Will Be Blown-In In August—Many Promising Prospects Indicate That Arizona's Future As A Lead And Zinc Producer Is Assured

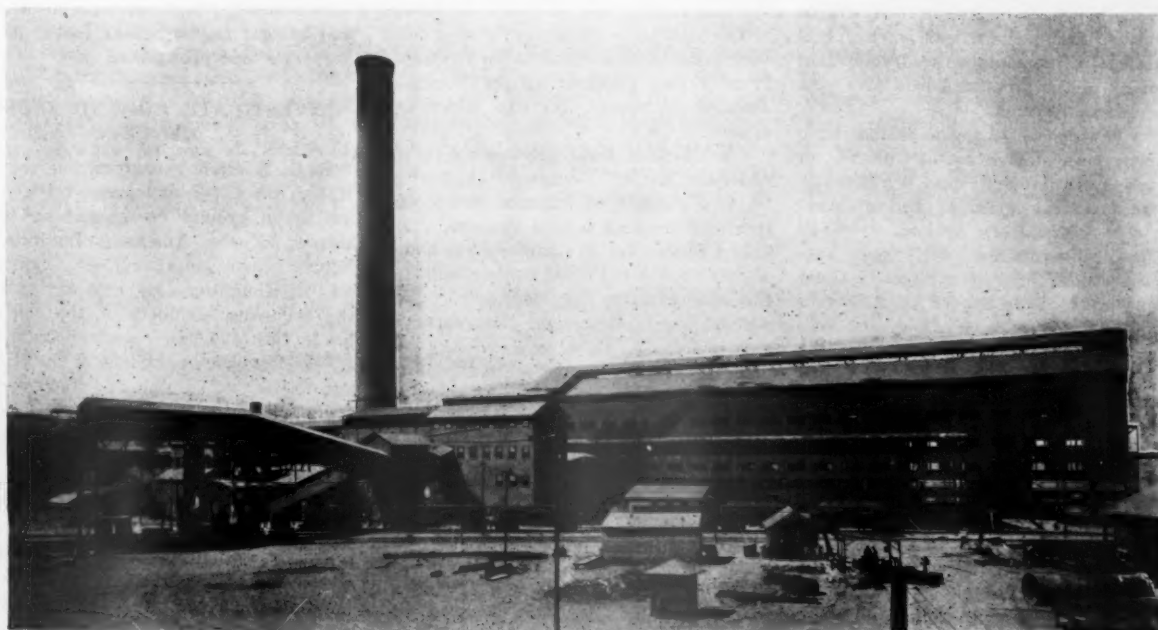
THE development of copper prospects in Arizona has been prosecuted very little in recent years, but there has been considerable interest in prospecting for and developing lead

*By W. B. GOHRING **

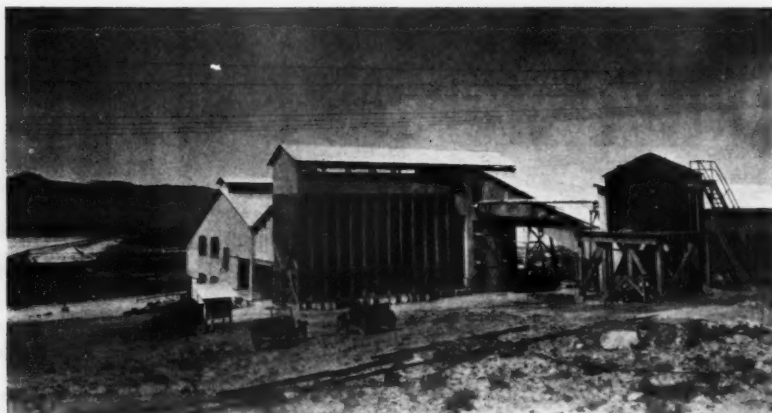
properties or properties that carry combined lead and zinc, and enough progress has been made to indicate that Arizona's production of lead will increase very rapidly in the near future.

Arizona ranked eighth among the lead-producing states in 1924, and almost all of the lead came from small bodies associated with the copper deposits of the large Bisbee Copper Mines, and from near-by Tombstone, where leasers produced considerable lead-silver ores.

* Secretary, Arizona Chapter, The American Mining Congress.



New Lead Smelting Plant of the Phelps Dodge Corporation at Douglas, Ariz.



Aside from the above, until very recently there has only been a small tonnage of lead, produced sporadically, from various small mines and prospects throughout the state. Today there are at least three new mills, working on lead or lead-zinc ores, that have started operations within the past year, besides several development campaigns on good-looking lead prospects elsewhere in the state.

All Arizona lead ores from the southern and central parts of the state have heretofore been shipped to the El Paso, Tex., plant of the American Smelting & Refining Company, while ores from Mojave County have usually been shipped to San Francisco or Salt Lake City, Arizona never having had a modern lead smelter of its own, but the Phelps Dodge Company is now just completing a small lead smelter at its copper-smelting plant at Douglas, and intends to handle not only its own lead ores from the Bisbee Copper Mines but also such custom ores as it can control. This plant will probably be blown in in August. It will be Arizona's first modern lead smelter, and doubtless will stimulate the development of many of the promising lead prospects in southern Arizona.

The new concentrating mills that have recently been started are at Chloride, in northwestern Arizona; near Wickenburg, in west central Arizona; and at Aravaipa, in southeastern Arizona.

The last-mentioned mill has been erected at an old lead mine in Graham County by a group headed by Arizona's Congressman-elect, L. W. Douglas. This company is known as the Grand Central Mining Company, and their mine development has been very satisfactory and apparently assures them of a long-lived lead production. An interesting sidelight on this enterprise is that Mr. Douglas will be the third straight generation of the Douglas family to develop a successful mine in Arizona. His father, J. S. Douglas, organized the United Verde Extension Mining Company, which developed that very rich copper mine in Jerome; and his grandfather, Dr. James Douglas, developed and headed the

One of the large copper companies that has recently paid a little attention to lead is the Calumet & Arizona Company, of Bisbee, which company is now developing a lead district of some promise near Benson, in southeastern Arizona. Several hundred thousand dollars worth of lead has been shipped out of the district by small leasers, and with the intensive development that will be given it now by the C. & A. there is a good chance for a considerable addition to Arizona lead production.

Besides this there are many other lead prospects being developed in various parts of the state, and it is extremely likely that from now on Arizona will



Above—Lead Concentrator of the Phelps Dodge Corporation, recently put in operation at Bisbee, Ariz. Below—Mill owned by Chloride Mining Company at Chloride, Mohave County, Ariz.

famous Copper Queen mine in Bisbee.

The mill at Wickenburg is at a mine which has just recently been developed from a raw prospect by the Tonopah-Belmont Company, Nevada silver operators.

The Chloride plant was erected by the Chloride Mining Company, headed by W. B. Twitchell, of Phoenix, and is successfully treating a lead-zinc ore.

The Phelps Dodge Company has added a unit to their Bisbee copper mill for the concentration of lead ores. This mill is now in operation. It treats 150 tons per day of either carbonate or sulphide ores by straight flotation process. The mill is equipped with a mechanical sampler and it will probably take in some custom ores. This unit is the first step in what may grow into a larger plant for the treatment of custom lead and zinc ores.

The Phelps Dodge Company has also taken over the mill of the Southwest Metals Company, at Humboldt, in central Arizona, and is remodeling it to receive custom lead and zinc ores, as well as copper.

have a steadily increasing output of lead and become an important factor in the country's lead production.

INVESTIGATE GROUND SUBSIDENCE

H. G. Moulton, consulting engineer, of New York City, chairman of the committee on ground movements and subsidence of the American Institute of Mining and Metallurgical Engineers, was in Houghton July 1 to confer with the following members of the committee in the Michigan copper district: Dr. W. O. Hotchkiss, president of the Michigan College of Mining and Technology; William Kelly, chairman of the board of control of the college; James MacNaughton, president of Calumet & Hecla Consolidated; and Prof. F. W. Sperr, of the mining department of Michigan Tech. W. R. Crane, superintendent of the experiment station at Birmingham, Ala., is making an exhaustive study of ground movements and subsidence in the Michigan copper country, on assignment by the United States Bureau of Mines.

SELECTION, CARE, USE AND STANDARDIZATION OF MINE DRILL EQUIPMENT

Three Types Of Rock Drills—Necessity For Thorough Knowledge Of Material To Be Encountered—Relation Between Speed And Yardage—Standardization Essential—Selection Of Drill Steel Discussed—Drill Expert Invaluable On Tempering

THERE are many factors which must be given consideration, when the selection of drilling equipment for any mining job is being contemplated. Not only will the given machine acquired be called upon to perform the work immediately under consideration, but also it must be of a type adaptable to changing conditions of work throughout its periods of usefulness.

The classification of rock drills falls naturally into three groups or types, the Drifter type for tunneling, drifting and cross-cutting work, the Stoper type for workings driven above the horizontal and the hand-held or Jackhammer type for workings driven below the horizontal. Of the three types there is a wide variation in weight, power and speed from which to select. This is, of course, true not only regarding the lines of drilling tools produced by any one manufacturer, but also owing to the considerable number of manufacturers, the purchaser is confronted by the necessity of making his selection both of manufacturer and of type offered. Obviously, owing to the author's connection, this discussion must be confined to rock drills only.

Taking up first in order, the type of Drifter drill best suited to a mining job of tunneling, crosscutting or drifting, the primary consideration will be, what are the characteristics of the rock which is to be drilled. Hardness is but a minor consideration as far as drilling is concerned. Soft fissured rocks, with their bedding or joint planes on which gauge material or clay is found, lying at a sharp angle to the line of hole really

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By J. E. HARDING*

present the greatest resistance to drilling, when resistance is taken to mean difficulty of drilling and time necessary to accomplish a certain footage of holes. Thus a full and complete knowledge of the character of the rock to be drilled is essential in selecting drilling equipment. Since in almost all mining jobs the variations of drilling conditions encountered run the gamut from hard and free drilling to soft and "fitchery," a drilling machine must be selected in which there is a well balanced design in both speed and power of hammer blow as well as power and positiveness of ratchet. A rock drill developing one of these features at the expense of the other means an unbalanced machine which will work well under one set of conditions and be a flat failure under the others.

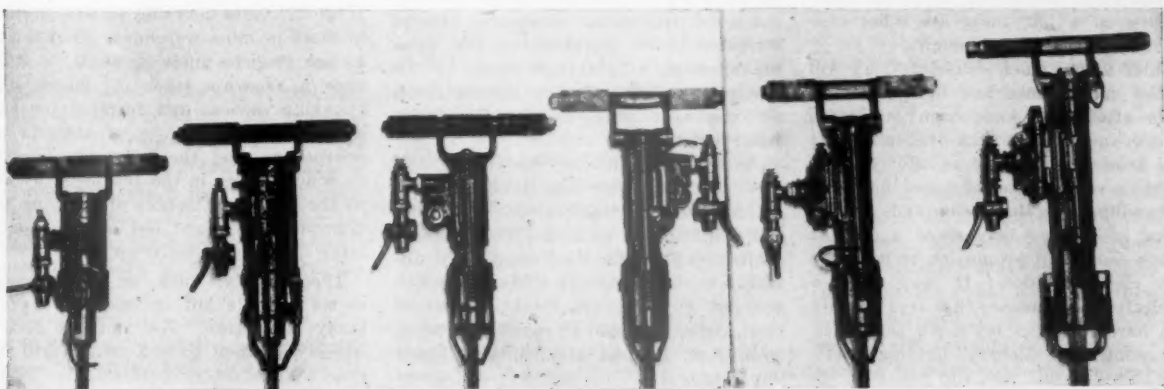
Another important consideration is how much hole is to be demanded from the drill in a given time. In the New Cascade tunnel, which A. Guthrie & Co. are driving for the Great Northern Railroad in the State of Washington, and where the making of world's records for speed is an almost monthly occurrence, the rock drills only do about two hours a day of actual drilling. At that location it is a daily race between the mucking machines and the rock drills, and in order that the one operation may not delay the other, speed is the only consideration. Each drill is putting down hole at the rate of about 18 inches per minute and very high pressure air is being used. Four machines are in use

at the face when two could very easily accomplish the work within the shift but contrary to what it would seem, this is the highest form of economy. In a tunnel such as the New Cascade, every minute which can be saved is so valuable that other considerations are unimportant.

On the other hand in general mining work, which must be carried on day by day over a period of many years, considerations which are negligible in a high-speed tunnel are highly important.

For the purpose of running a mine drift, a machine should be selected of either the one or two-man type, which is capable of drilling enough footage of hole to get in a depth of round, which can be pulled, which will furnish enough muck to keep the muckers busy all the shift and do that work in the amount of time available in an eight-hour shift, with due allowances made for unforeseen delays.

The matter of whether a one or two-man drill, that is a drill of lighter or heavier weight should be selected, should be based on the hardness or difficulty of the rock to be drilled, the speed at which it is desired to drive the given drift, the available amount of compressed air, the compressor capacity and the kind and amount of locally available labor. Adding an extra man to a heading crew and a heavier drill in many cases will increase the footage driven to such an extent that the final cost per foot driven will come out at a lower figure than if less men and a lighter drill are used. Given the local conditions pertinent to a given job it should be a matter of no great difficulty to determine the size and



Jackhammers of various sizes and weights

weight of a drifter drill most desirable for any particular job or mine.

The field of the stoper type drill and the machines available for that type of work are fully as variable as those of the drifter drill although the matter of labor is simplified by the fact that as a general rule only one man is required to run any of the present day stopers. These drills as we now have them are of either the wet or dry type and of either automatic or hand rotated type. In these types there is also a wide variation in weight, power and speed.

While the latest type of self rotated wet stoper is comparatively speaking a new development, it gives promise of displacing practically all other types. The designers have been able to get the weight down to such proportions that it can be handled with no great difficulty and its great drilling speed renders it a highly desirable machine.

The hand-held, self rotating, or "Jackhamer" type of machine finds its widest field in shaft and winze sinking and in block holing work for secondary drilling and blasting in quarries, open cuts, mines and stopes. Practically all the manufacturers furnish their drifter type drills equipped with a handle for shaft sinking work. This makes a very powerful drill for such work and as long as holes are drilled downwards at a steep angle, the usual practice in shaft sinking, the use of the heavier machines is defensible.

For the general work done by the "Jackhamer" type of drill, however, the transformation of heavy drifters into this type of drill makes a machine too heavy and too hard to handle. This is especially true in view of the different weights and capacities to be had in standard machines of the "Jackhamer" type.

Thus, with a knowledge of the rock and working conditions, the engineer should have no great difficulty in determining the size and type of rock drill he requires for any given job. When he gets down to the selection of the types of machines which will be most satisfactory on a job, there are other considerations to be given weight.

Chief among such considerations will be the maintenance and upkeep of the drills after they have been purchased and put into use. A rock drill in a short time trial may appear to offer a very desirable combination of speed and ease of handling but that same drill over a period of a year may show a cost of upkeep out of all proportion to its other good characteristics. It may show a wonderful performance in a free drilling or a hard rock, yet lay down cold when it encounters a "fitchery" drilling condition. This means that the power of its blow is out of proportion to the power of its rotating mechanism. In such a case

the machine will go to pieces rapidly and the upkeep bill overshadows all its other advantages. It is not only the actual cash value of the new parts which have to be replaced which is of importance, but also the time lost while the machine is being repaired and the rounds lost owing to the machine being out of commission when it should be drilling.

Deep down-hole drilling is a special case and for this is required a powerful blow, strong blowing either with water or air and above all a powerful ratchet. No designer has yet been able to incorporate these three features in any light weight drill and as an illustration of what ratchet power means there is the following observation. A short time ago two drills were being tested on deep down-hole work. They were of slightly different weight and entirely different in design. On the one when the rotation stopped operating it was possible for one man to rotate the steel with a 36-in. Stillson wrench. When the steel stuck so tightly that two men with 36-in. wrenches were unable to rotate it, the other machine was placed on the same steel and owing to its rotating power, could rotate the steel and finished out the hole.

In the cases where entirely new drilling equipment is to be acquired, the engineer by properly studying his conditions, should be able to standardize on a single machine each, of the drifter, stoper and jackhamer type. When such decision is possible, the result is a great economy in the number of spare parts to be carried in warehouse stock, labor becomes accustomed to working with the same type of machine and the general well being of the entire operation is promoted.

Unfortunately the actuality is generally not as simple as that. The average mine has been building up for a number of years and acquiring its drilling equipment, and the new equipment to be added must fit in with that which is already on the job. Many cases there are when economy would be accomplished by a wholesale scrapping of already possessed equipment. Under the present condition of the metal market, the mine management is governed more by his financial condition than by his conviction and wholesale scrapping of usable equipment is not now in order.

As a part of drilling equipment, drill steel is hardly less important than the drilling machines themselves. The modern high-speed rock drill delivers a punishment to the steel completely unknown to the slower types of machines in use but a few years since. A hollow steel, either hexagon or round in section, is in most general use, while of lesser importance are the cruciform and quarter octagon section.

Many of the steel makers are now pro-

ducing hollow drill steel, some good, some bad and some indifferent. The drill steel needed must be able to take a hard temper for cutting rock and it must be able to stand vibration. One chemical formula of steel might be all right as far as tempering is concerned, yet be practically worthless on account of its inability to stand up. Obviously the steel offering these two qualities, namely, tempering and durability, is the one which should be selected. The matter of first cost is of relatively slight importance when consideration is given to the fact that the difference of a few cents per pound in first cost between one steel or another when compared to the labor and other costs of making up from bar stock amounts to a very small percentage. This matter very easily figures out that a steel which will give 2 percent more service is worth about 1 cent per pound more in the bar.

No matter how good or how expensive the original steel may be, its value in service is nullified if it is not properly handled in the blacksmith shop. Fortunately, sharpening machinery has kept pace with the other developments of drills and steels and we have machines which rapidly turn out both bits and shanks properly formed and gauged.

During the past years there have been many controversies on the subject of shape of drill bits. At present the question has simmered down to almost universal use of a cross bit. Out of much experimenting, and incidentally much controversy, this type has come to be an almost universal standard. The cross bit with the 90-degree cutting edge, the 5-degree taper at the corner changing to a 14-degree taper toward the shank has been found not only the most efficient in use but also it renders itself nicely to the operation of the sharpening machines.

At some mines an effort has been made to standardize on one single section of steel for all types of machines and use the same shanks and bits for all machines. The idea behind this movement is to eliminate carrying several sections of steel in mine warehouse stock, either as bar steel or made up stock, to eliminate a separate stock of dollies, dies, shanking devices and formers for handling different sections of steel in the sharpeners, and the labor of changing such accessories in the sharpener as well as the labor and trouble of handling and transporting in and out of the mine a large quantity of made up steel.

Theoretically, such an arrangement seems feasible but it leads to a great many difficulties. The smallest section which will stand up in a drifter drill and give a satisfactory performance, is the inch and a quarter hollow round. Using a smaller section can be done, but it is

not economical, owing to the high breakage of steel which is bound to result.

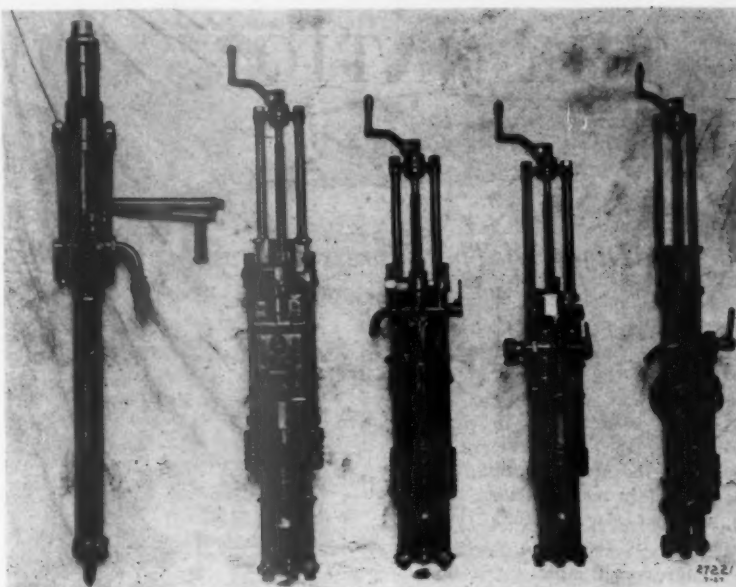
By the same token, inch and a quarter hollow round steel is too large and heavy for any machine of the "Jackhammer" type now in general use. Arranging the front head and chuck of a machine of this type to take the standard Leyner lugged shank, does not result at all well and besides that, the minimum bit which must be forged on inch and a quarter steel to give clearance, is so large that the drilling speed of such a machine is greatly retarded. In wet stopers, however, there is not so much objection, but the Leyner lugged shank is rather too small in bearing surface to give best results. Thus, standardizing on one section of drill steel is hardly to be recommended.

But by a proper use and make up, there is no reason why the drill steel at any mine can not be restricted to two sections, namely, inch and a quarter hollow round, and one inch hollow hexagon, the former for either drifters or stopers and the latter for either Jackhammers or stopers, depending upon the rock drilling conditions to be encountered.

There is no question but that the average mining operation should give very careful attention, and as a rule very much more careful attention, to upkeep and maintaining drilling equipment. Money and time spent in this will be returned manifold. Cheap and efficient mining depends more than on almost any other feature, on fast and efficient rock drills and no matter how well and carefully a drill may have been designed and manufactured, it can not deliver performance if it is not properly maintained and looked after. At some mines the cost of upkeep is triple or quadruple what it should be and performance is correspondingly reduced by time lost through mechanical failures, changing drills, etc. When a drill is not hitting it is not making any money for its owner and to make the most possible it must run at high speed and high efficiency, which it can not do if it is not properly looked after.

At any high cost mine a careful analysis of the local conditions will generally point the way to economy. For instance, the water pressure should never be higher than the air pressure, because if the water pressure is too high, the water is bound to pass into the cylinder and carry away the lubricant from the working parts, greatly adding to the friction wear.

Low pressure air, especially on stoping drills, is as destructive as abnormally high pressure air because low pressure air lets the machine fall away from the steel and the hammer blow is received



Modern Rock Drills—From left to right: Stoper, 108 lbs., automatic rotation, controlled air and water feed; Drifter, 210 lbs., for deep hole and hard rock drilling; Drifter, 164 lbs., two-man operation; Drifter, 123 lbs., one-man operation; Drifter, light weight, 104 lbs.

on the front head of the machine instead of on the drill steel. Most stoping drills are designed with a stoping piston head of a proper size to operate on 80 to 90 pounds air. Consequently low pressure does not hold them up.

There are mines where the rock is very hard and a single bit is run too long. A little experimenting will show very closely the maximum depth of hole which a sharp bit will cut and when a bit has become dulled there is no economy in using it further. It is possible by arranging steel length and bit size to change steel every 10 or 12 inches instead of every 20 or 24 inches and effect a great economy in drill upkeep as well as greatly to increase drilling speed.

The forming and tempering of shanks is of the utmost importance. The shanks should be tempered in oil, hard enough so that they will not batter, but they should be softer than the piston which hits them, the thing to be avoided most being a hard tempered shank which chips and which a file can not touch. Pistons cost anywhere from \$8 to \$45 and one shank which chips may completely ruin a piston worth somewhere between those amounts.

Proper maintenance of the general air service lines also has an important bearing on drill upkeep cost. Such lines should be of adequate size to hold up pressure and hold down friction loss; they should be tight and clean and arranged so that pockets of water can not collect at low spots.

Nearly every mine of any size at all

now maintains a "Drill Doctor" and his functions are to hold upkeep costs down. He should be a mechanic with judgment enough to throw away parts which are worn out and not throw away parts which are still serviceable, as well as to see that machines are brought to his shop for regular and periodic overhauling and inspection. A good "Drill Doctor" more than saves his salary on almost any drilling job.

Most important of all in keeping drill costs down is to give the machines plenty of lubrication, which means abundant good oil available at all times. There are several types of automatic lubricators at present on the market which are placed in the air line itself. The only attention they require is to be filled about once a day and with that service they automatically inject a small amount of oil into the air as it passes to the machine and keeps them well lubricated at all times.

Thus the manufacturers have provided lines of drilling equipment in a wide variety of power, speed and weight adaptable to every condition which is liable to be encountered in general mining work, together with the necessary accessories of sharpening and heating equipment, and drill steel. From such variety the user is enabled to select that most suitable to his local conditions and having selected it he should be able to secure satisfactory performance if he adheres to what might be designated as standard methods of maintenance and handling.

THE NATION'S VIEWPOINT



A Digest Of The Expressed Opinions Of Leaders In American Affairs

FORMER Senator Charles S. Thomas, Colorado, recently presented in the *Washington Post* a unique viewpoint concerning Congressional ethics with respect to vote-buying. Among the first matters to be taken up by the next Congress, are the rights of certain members-elect to their seats, so that the Senator's thoughts are timely. He says:

"Congressional ethics regarding the general subject of political expenditures graphically illustrate the theory of that school of philosophy which contends that morality is wholly conventional—a state of mind rather than a code of fundamental precepts governing human conduct.

"This legislative attitude is neither new nor novel. It is old as democracy, and perhaps older. But it is aptly illustrated by the activities of the Sixty-ninth Congress, whose moral sense has been rudely jolted by the misconduct of senatorial aspirants for primary nominations in Pennsylvania and Illinois. In Pennsylvania Senator Pepper and his friends expended nearly \$2,000,000; Senator-elect Vare and his friends nearly \$1,000,000 and Governor Pinchot nearly \$200,000 upon the state electorate in contesting for the prize, and Mr. Vare won. Mr. Frank L. Smith, Republican, and Mr. George Brennan, Democrat, spent relatively less in Illinois. Representing different party organizations, both were nominated, but Smith won in the subsequent election. Disclosure of these facts gave the Senate what threatens to be a permanent shock. It has, nevertheless, concentrated its wrath upon the two winners. Governor Pinchot, whose disbursements exceeded those of Senator Newberry, of Michigan, in 1918, and who ran with the hares at the primaries, has been hunting with the hounds since his defeat, while the indiscretions of Pepper and Brennan are rapidly passing into oblivion.

"Messrs. Vare and Smith are not alone in the vote-getting business. Congress is an ancient and formidable competitor, possessed of an immense advantage. Vares and Smiths must needs spend their own money



We Need a New Bucket

and that of their friends in promoting their political fortunes, but Congress draws freely upon the vast reservoir of the public revenues and upon national credit lying beyond it. They debauch the electorate with their own money; Congresses and the legislatures do it by statute, with the public funds, hence it is lawful per se. No risks are taken, and therefore no aftermath of embarrassments. What is our pension and bonus legislation but the exchange of public money for soldiers' votes?

"What are our rivers and harbors bills, public building bills and all others of the pork variety, but 'votive'



New York Evening Post

"But Nobody's Looking, Darn 'Em"

tributes to compact minorities organized to raid the Treasury? And last, but not least, what is the pending Haugen-McNary bill, ostensibly for farm relief, but a surrender of the national legislature to the compact forces of an agrarian minority strenuously demanding an initial appropriation of \$250,000,000 as an alternative to its political displeasure? The demand failed last year. It now renews its assault with an apparent certainty of success because its forces are augmented by a compact with the cotton planter and tobacco grower, with whom the coveted spoils are to be shared.

"Here is a trinity of power before which many Senators heretofore in opposition are obsequiously kowtowing. Their previous objections to the bill were both sincere and genuine. They were based upon irrefutable principles. They are as irrefutable now as they were last spring, yet they are silenced in large degree by the coalition of wheat, cotton and tobacco.

"The scheme is as fantastic as Plato's Ideal Republic. It defies economic law and all human experience. Even if it were capable of practical administration and within constitutional warrants of power, it would carry the Government far afield from its legitimate functions. But it is a vote-getter, and as such easily commands the majority of the legislative branch of the Government, which instinctively appeals for its conduct to many like precedents of its own establishment.

"Between the candidate who uses his own fortune to secure political advancement and the legislative majorities devoting the public moneys to the same purpose, there is no difference in principle or in morals, unless it be that the latter is the more reprehensible."

The following excerpt from an article in *World's Work* for March by Col. Robert H. Montgomery, one of the outstanding authorities on income tax procedure, touches two of the questions that are giving the staff of the Joint Congressional Committee on Internal Revenue

Taxation serious concern; inequities in the present law and uncertainty in determination of tax liability. How can these be eliminated? The Joint Committee wants suggestions. Here is what Col. Montgomery says:

"To a very limited extent do the citizens of the United States contribute to the Federal revenues, through the income tax, in proportion to their ability to pay. Less than 5 percent of the population make any returns or pay any tax. More than 95 percent pay no income tax. The exemptions are very large and eliminate many who should make some contribution, even though it were small. Those who are best able to pay, namely, the idle rich, have always received special consideration, and due to the intricacies of our laws many who have made large fortunes have paid little if any tax. When the amounts paid by all taxpayers were published it was found that many enormously rich men and women paid trifling amounts. On the other hand, the professional and industrial classes have paid more than their share and out of all fair relation to others. This includes officers of the Army and Navy and other Government employees who must always pay on their gross incomes and who have been deprived of reasonable deductions for expenses arising out of their employment. "Ability to pay" should always take into account the element of continuity of employment, and the element of the using up of one's brain capital should be considered.

"In dealing with this question, Congress with characteristic sagacity resolved to grant a differential to "earned" incomes as distinguished from "lazy" or "funded" incomes. It decided that a taxpayer receiving "earned" income of \$5,000 a year



Cincinnati Enquirer
For the Best Reason in the World

should receive a rebate of 25 percent of his taxes. It was intended to be a political gesture but it has turned out to be a stupid blunder, as will be seen by the following illustration, which is extreme but not unusual. In the case of a taxpayer receiving a salary of \$5,500 a year, who has a wife and four children, the allowance for "earned" income, that is the reduction in tax, is \$1.50. Now comes the exquisite irony of the law. In the case of a young child to whom there has been left bonds yielding an income of \$5,500 a year there is an allowance for "earned" income of \$13.12, or nearly nine times as much of an allowance for the child in arms as for the married man with a family, who really works for every dollar of his income. Thus ability to pay is dealt with in such a silly way as to disgust taxpayers. The so-called exemption was carefully worked out after years of consideration and was announced as a wise political act, since it recognized the superior claim of the working man. But, like most other Congressional so-called ameliorations, it is just bunk. Nevertheless, it must be regarded as typical since it represented the result of long and serious consideration.

"No one has ever publicly criticized the maxim that the tax should be certain and the amount to be paid clear and fixed, yet under our present system the tax is uncertain and the amount to be paid is obscure and very movable. In a vast number of cases it is impossible for taxpayers to know whether they are liable for any tax, or if so, how much. In the first place, our tax laws usually are not passed until after the time to which they

relate has passed. The present law was passed February 26, 1926, but was made effective as of January 1, 1925. Thus during the entire year 1925 taxpayers did not know what was taxable and what was not taxable, and even if they thought certain transactions might be taxable they had no idea what the rate of tax would be.

"And the tax should be certain. Under no system will it ever be possible to avoid some mistakes, but under a sensible law there need be no such amazing figures as were reported by the Commissioner of Internal Revenue for the fiscal year ended June 30, 1924:

Cash refunds	\$118,311,079
Abatements and credits allowed	334,271,612
Claims rejected	375,288,794
Claims received	1,515,786,087

"The figures are appalling. The pity of it all is that many of those who should have made claims will never realize their lost opportunities. Herein lies the greatest curse of a defective tax system. Astute taxpayers protect themselves and pay no more than the law demands. When a tax is uncertain, timid and conservative souls pay too much and rarely get back their excessive payments.

"Unless we have a new system there will grow up in this country a small group of men learned in the law, most of them ex-government employees, who will claim to be able to interpret our tax laws, and while they may not be able to do it, they will be able to charge high fees since the taxpayers themselves will never know the difference."



Chicago Tribune
That's My Boy



The Home News.
Gosh! Isn't It Tantalizing

STATISTICS OF THE COPPER INDUSTRY IN THE UNITED STATES IN 1926

SMELTER and refinery production of copper in the United States continued to break peace-time records in 1926, according to final statistics for that year prepared by the United States Bureau of Mines. Smelter production of copper from domestic sources in 1926 was 4 percent in excess of production in 1925, and refinery production from domestic and foreign sources exceeded the 1925 figures by 5 percent. A decrease of 35 percent in smelter production in California and increases of nearly 42 percent in production in Nevada and 27 percent in production in Michigan were notable features of the domestic industry. Domestic consumption of new copper, as indicated by withdrawals from total supply on domestic account, increased 12 percent, but was unable to offset the increased imports and decreased exports, and an increase in stocks of refined copper resulted. Stocks of refined copper were very low at the end of 1925, however, and stocks at the end of 1926 were, with the exception of 1925, the lowest recorded since January 1, 1918. Stocks of blister copper also increased. The average price for copper was a little lower in 1926 than in 1925. A summary of the statistics for 1926 follows:*

The figures here given are obtained from smelters and refiners and represent the metal actually recovered, in terms of blister and refined copper, from materials treated in 1926. These figures do not exactly correspond with those showing the copper mined during the year. Annual smelter production and mine production, representing different steps in the production of copper, should not be confused as they do not agree precisely.

SMELTER PRODUCTION

The smelter production of primary copper from domestic sources during 1926 amounted to 1,739,622,094 pounds, an increase of approximately 4 percent. The value of smelter production increased approximately 2 percent in 1926. The average price of 2,751,000,000 pounds of copper delivered during the year, as reported to the Bureau of Mines by selling agencies, was 14.0 cents a pound.

In the accompanying table the production is apportioned to the states in which the copper was mined. The figures represent the content of fine cop-

*A more comprehensive report, entitled "Copper in 1926," is in preparation and will be published as a part of a general review of the production and resources of metals in that year. The brief statement here presented is published in advance of the complete report in response to a demand for official figures at the earliest possible date.

COPPER IMPORTED INTO THE UNITED STATES IN 1926, IN POUNDS

Country	Ore (copper content)	Concentrates (copper content)	Matte and regulus (copper content)	Unrefined black blister and copper in bars, pigs, etc.	Refined in plates, rods or other forms	Old and clippings for remanufacture	Composition metal, copper chief value
Africa:							
British South.....				52,601,821		2,967	
Portuguese:							
East.....	20,271			83,314,732	910,206		
Other.....				449,642		180	
Australia.....	248,646						
Canada.....	47,609,027	7,963,626	107,655	44,961,029	685	6,002,507	135,508
Chile.....	33,074,184	848,861	202,836	31,365,100	166,872,641	343,351	
Cuba.....	5,433,042	14,471,381				1,926,861	10,980
France.....	1,146,285	37,300	42,114	1,131,955			
Germany.....	107,742	623,836		216,325	59,387	205,171	70,273
Mexico.....	2,862,187	18,821,148	971,943	82,320,581	210,874	68,624	
Peru.....	1,066,055	358,562	99,945	93,907,544		6,579	
Spain.....	13,480,257			24,783,133			
United Kingdom.....	270,617	183,644	250,783	27,743,879	2,069,115	890,199	111,244
Venezuela.....	276	1,345,408				1,687	
Other countries.....	1,417,040	76,440	313,046	1,002,493	442,858	1,553,513	153,27
	106,715,358	44,750,477	2,129,042	443,798,297	170,565,766	11,001,589	481,274
	\$13,452,075	\$5,351,557	\$261,443	\$56,101,041	\$23,335,640	\$1,114,436	\$63,769

SUMMARY OF FEATURES OF THE COPPER INDUSTRY IN THE UNITED STATES, 1925 AND 1926

	1925	1926
Production of copper:		
Smelter output.....pounds..	1,674,896,886	1,739,622,094
Mine production.....do....	1,678,117,747	*
Refinery production of new copper—		
Electrolytic.....do....	1,533,995,439	1,553,041,424
Lake.....do....	138,029,764	172,372,304
Casting.....do....	10,870,144	5,883,433
Total domestic.....do....	1,682,895,347	1,731,297,161
Total domestic and foreign.....do....	2,204,573,824	2,322,485,376
Total new and old copper.....do....	3,045,000,000	
Ore produced:		
Copper ore.....short tons..	53,103,014	*
Average yield of copper.....percent..	1.54	*
Copper-lead and copper-zinc ores.....short tons..	228,612	*
Average price per pound.....cents..	14.2	14.0
Imports (unmanufactured).....pounds..	652,971,407	779,441,803
Exports of metallic copper.....do....	1,082,369,439	960,220,112
Withdrawn from total supply on domestic account:		
Total new copper.....pounds..	1,401,012,091	1,570,136,207
Total new and old copper.....do....	2,241,000,000	
Stocks of refined copper.....do....	124,000,000	146,000,000
Stocks of blister and materials in solution.....do....	432,000,000	455,000,000
Value of production in the United States.....pounds..	\$237,832,000	\$243,547,000
World's production.....pounds..	3,053,995,000	*

* Figures not yet available.

† Total exports of copper, exclusive of ore, concentrates, composition metal, and unrefined material.

‡ At the end of the year.

COPPER PRODUCED IN THE UNITED STATES FROM DOMESTIC ORES, 1925-1926 (Smelter output, in pounds fine)

State	1925	1926
Alaska.....	72,204,166	67,631,846
Arizona.....	722,653,457	729,324,587
California.....	46,943,604	30,442,961
Colorado.....	3,163,211	4,657,591
Idaho.....	3,144,064	1,171,262
Michigan.....	138,029,764	174,778,884
Missouri.....	12,114	54,378
Montana.....	270,604,676	257,271,936
Nevada.....	77,137,563	109,041,769
New Mexico.....	76,467,245	82,848,096
North Carolina.....		1,468,746
Oregon.....	126,107	279,223
Pennsylvania.....	562,240	495,698
South Dakota.....	2,336	2,714
Tennessee.....	19,789,234	18,601,586
Texas.....	785	17,102
Utah.....	242,730,986	259,649,158
Vermont.....		446,323
Washington.....	1,184,807	1,336,617
Wyoming.....	331	
Undistributed.....	113,196	101,667
	1,674,869,886	1,739,622,094

PRIMARY AND SECONDARY COPPER PRODUCED BY REGULAR REFINING PLANTS AND IMPORTED, 1925-1926, IN POUNDS

	1925	1926
Primary:		
Domestic—*		
Electrolytic.....	1,533,995,439	1,553,041,424
Lake.....	138,029,764	172,372,304
Casting.....	10,870,144	5,883,433
	1,682,895,347	1,731,297,161
Foreign—*		
Electrolytic.....	516,632,536	588,932,738
Casting.....	6,045,947	2,255,427
Refinery production of new copper.....	2,204,573,824	2,322,485,376
Imports of refined copper.....	99,773,546	170,565,766
Total new refined copper made available.....	2,304,347,370	2,493,051,142
Secondary:		
Electrolytic.....	140,349,541	163,061,465
Casting.....	58,010,653	62,066,941
	198,360,194	225,118,406
	2,502,707,564	2,718,169,548

* The separation of refined copper into metal of domestic and foreign origin is only approximate, as an accurate separation of the amounts at this stage of manufacture is not possible.

an increase of 118,000,000 pounds over that in 1925.

In addition to their output of metallic copper the regular refining companies

per in the blister produced, the smelter output of ingot, and anode copper from Michigan.

REFINED COPPER

The total production of new refined copper in 1926 was 2,322,000,000 pounds,

COPPER EXPORTED FROM THE UNITED STATES, 1926, IN POUNDS

Country	Ore, concentrates, composition metal and unrefined copper (copper content) other forms	Refined in bars, ingots or other forms	Old and scrap	Pipes and tubes	Plates and sheets	Wire (except insulated)	Insulated wire and cable	Rods
Belgium		82,058,980	18,632		44,852	868	6,782	22,852
Canada	163,043	15,288,339	2,811,469	2,286,220	1,578,837	765,636	1,749,467	11,517,562
China		8,167,056	36,520	15,852	26,628	60,510	280,204	
Denmark and Faroe Islands		867,701			1,225	67,382	28,291	1,343,675
France	109,673	175,150,816	365,933	57	818,086	163,324	134,872	2,783,828
Germany	4,610,828	163,360,480	8,745,244	2,360	504,581	37,753	4,515	
India (British)		4,415,087	22,820	3,429	222,871	625,433	195,536	
Italy		82,957,238	33,030	120	336,721	40,966	7,488	111,081
Japan (Including Chosen)	2,295	87,343,661	5,043,581	90	9,460	656,835	85,357	1,590
Netherlands		64,286,443	572,346	5,057	38,042	338,030	48,981	112,181
Norway		951,333		1,313		335	23,485	932,458
Spain		9,656,520		153		146	15,800	1,503
Sweden	112,323	24,711,844		49	3,087	4,462	15,858	
Switzerland						2,944	43,925	
United Kingdom	466,864	180,320,237	1,424,703	20,417	464,157	1,444,833	792,457	19,733,655
Other countries	126	16,588,793	351,334	918,101	983,643	8,822,871	15,139,530	8,230,072
	5,465,152	856,124,528	19,426,112	3,253,218	5,032,190	13,041,128	18,552,529	44,790,407
	\$611,630	\$121,231,224	\$1,178,330	\$839,953	\$1,075,143	\$2,244,235	\$4,816,128	\$6,856,722

STOCKS OF COPPER JANUARY 1, 1922, 1923, 1924, 1925, 1926, AND 1927, IN POUNDS

Year	Refined copper	Blister and material in process of refining *
1922	459,000,000	283,000,000
1923	216,000,000	361,000,000
1924	264,000,000	432,000,000
1925	243,000,000	393,000,000
1926	124,000,000	432,000,000
1927	146,000,000	455,000,000

* The amounts stated in the last column in the table above do not include copper in stock at foreign smelters or in transit from foreign smelters to refineries in the United States.

NEW REFINED COPPER WITHDRAWN FROM TOTAL YEAR'S SUPPLY ON DOMESTIC ACCOUNT, 1925-1926, IN POUNDS

	1925	1926
Total supply of new copper	2,304,347,370	2,493,051,142
Stock at beginning of year	243,000,000	124,000,000
Total available supply	2,547,347,370	2,617,051,142
Copper exported *	1,022,335,279	900,914,935
Stock at end of year	124,000,000	146,000,000
	1,146,335,279	1,046,914,935
Withdrawn on domestic account	1,401,012,091	1,570,136,207

* Includes refined copper in ingots, bars, rods, or other forms.

produced bluestone (hydrous copper sulphate) having a copper content of 8,498,000 pounds, as compared with 6,754,000 pounds in 1925.

CONSUMPTION

The new refined copper withdrawn from the total year's supply on domestic account in the United States in 1926 and the method employed in determining it are shown in the following table, which does not include stocks of copper held by consumers.

IMPORTS AND EXPORTS

The figures of imports and exports of copper reported by the Bureau of Foreign and Domestic Commerce are shown above:

OUTPUT OF METALS IN OREGON IN 1926

THE value of gold, silver, copper and lead produced in Oregon in 1926 was \$334,740, according to J. M. Hill, of the United States Bureau of Mines, Department of Commerce. This represents a decrease of \$96,013, or 22 percent, as compared with the value of metals produced in 1925. The output of gold and silver decreased and that of copper and lead increased. The number of mine operations (49 lode and 100 placers) was practically the same as in the previous year. Considerable development and prospecting were under way in both eastern and southwestern Oregon.

The gold production in 1926 was 13,243.10 ounces, valued at \$273,759. Of this amount the lode mines produced 7,304.68 ounces, valued at \$151,001, and the placers 5,938.42 ounces, valued at \$122,758. The yield of gold from placer mines decreased 34 percent and that from lode mines 27 percent. Dredges produced 60 percent and hydraulic mines 24 percent of the gold from placer operations. Of the gold produced by lode mines 6,646.45 ounces came from gold ore, and 657.94 ounces from copper ore. This represents a decrease in yield from gold ore of 2,907.89 ounces, or 30 percent,

but the gold from copper ore increased 282.88 ounces or 75 percent. One silver mine yielded a negligible amount of gold.

The silver yield of the state was 29,733 ounces, of which the lode mines produced 28,890 ounces and the placers 843 ounces. Of the 28,890 ounces from lode mines 21,963 ounces, or 76 percent, came from gold ore, and 6,665 ounces, or 23 percent, from copper ore.

The production of copper in Oregon in 1926 was 296,454 pounds, 190,129 pounds more than in 1925. A small amount of copper came from gold ore, but the principal output was from copper ore shipped from Baker, Douglas, Grant and Josephine counties. Copper explorations near Keating, Baker County, were carried on further during 1926.

The lead output in Oregon in 1926 was 11,549 pounds, an increase of 5,937 pounds over the output in 1925. Grant County contributed the greater part of the lead in 1926, whereas the lead output in 1925 came from Baker and Jackson counties.

Accompanying is a table showing the output of all metals in Oregon in 1926, by counties.

MINE PRODUCTION OF GOLD, SILVER, COPPER AND LEAD IN OREGON, 1926, BY COUNTIES

(In terms of recovered or recoverable metal)

Advance figures by J. M. Hill, of the Bureau of Mines

County	Gold		Silver		Copper Pounds	Lead Pounds	Grand total value
	Fine ounces	Value	Fine ounces	Value			
Baker	3,655.43	\$75,564	9,061	\$5,654	234,578		\$114,059
Coos	30.75	636	4	3			639
Curry	67.23	1,390	12	7			1,397
Douglas	159.13	3,290	2,854	1,781	47,080		11,662
Grant	5,540.50	114,532	15,739	9,821	2,566	11,273	125,614
Jackson	530.69	10,970	83	52			11,022
Josephine	2,747.46	56,795	253	158	12,118		58,650
Lane	81.71	1,689	28	17			1,706
Malheur	400.94	8,288	343	214			8,502
Marion	26.22	542	1,354	845	112	276	1,425
Wheeler	3.04	63	2	1			64
	13,243.10	273,759	29,733	18,553	296,454	11,549	\$334,740

Note—Average value of metals: Gold, \$20.67 per ounce; silver, \$6.624 per ounce; copper, \$0.14 per pound; lead, \$0.08 per pound.

OUTPUT OF METALS IN CALIFORNIA, 1926

MINE PRODUCTION OF GOLD, SILVER, COPPER, LEAD AND ZINC, IN CALIFORNIA IN 1926, BY COUNTIES

(In terms of recovered or recoverable metal)

Advance figures by J. M. Hill, of the Bureau of Mines

County	Gold		Silver		Copper	Lead	Zinc	Grand
	Fine ounces	Value	Fine ounces	Value	Pounds	Pounds	Pounds	total value
Amador	104,841.95	\$2,167,275	21,510	\$13,422	.....	825	.....	\$2,180,763
Butte	13,924.91	287,853	4,803	2,997	.....	.....	.....	290,850
Calaveras	27,907.00	576,889	9,983	6,229	5,240,733	.....	.....	1,316,821
Del Norte	52.17	1,078	6	4	.....	.....	.....	1,082
Eldorado	4,440.31	91,789	756	472	.....	.....	.....	92,261
Fresno	415.80	8,595	84	52	.....	.....	.....	8,647
Humboldt	60.14	1,243	10	6	.....	.....	.....	1,249
Imperial	11.49	258	31	19	282	361	.....	325
Inyo	1,299.89	26,871	124,508	77,693	36,845	6,556,810	69,027	639,441
Kern	6,555.18	135,508	7,479	4,667	.....	.....	.....	140,175
Lassen	3.23	67	1	1	.....	.....	.....	68
Los Angeles	4.53	94	68,362	42,658	.....	1,159,600	2,523,600	324,794
Madera	82.62	1,708	35	22	.....	.....	.....	1,730
Mariposa	8,819.38	182,313	2,433	1,518	.....	.....	.....	183,831
Modoc	7.62	158	5	3	.....	.....	.....	161
Mono	977.35	20,204	194,557	121,404	2,263	20,905	.....	143,597
Monterey	34.13	706	5	3	.....	.....	.....	709
Napa	373.13	7,817	81,116	50,616	.....	.....	.....	58,433
Nevada	112,174.19	2,318,846	48,101	30,015	.....	.....	.....	2,348,861
Orange	2.88	60	1,550	967	.....	5,127	40,000	4,437
Placer	4,011.30	82,921	554	346	.....	.....	.....	83,267
Plumas	11,980.91	247,667	347,147	216,620	22,163,035	326	.....	3,567,138
Riverside	141.77	2,931	5,024	3,135	22,125	173,207	.....	23,021
Sacramento	63,083.24	1,304,046	2,607	1,627	.....	.....	.....	1,306,673
San Bernardino	5,170.10	106,875	884,045	551,644	176,919	160,211	.....	696,825
San Diego	510.05	10,543	545	340	.....	3,173	4,000	11,437
Santa Cruz	6.93	143	1	1	.....	.....	.....	144
Shasta	6,429.31	132,906	177,434	110,719	5,061,355	3,963	17,797,210	2,287,323
Sierra	27,305.37	564,462	4,669	2,913	.....	.....	.....	567,365
Siskiyou	6,832.49	141,240	1,137	709	.....	.....	.....	141,949
Stanislaus	6,162.90	127,398	659	411	.....	.....	.....	127,809
Trinity	23,387.90	483,471	21,275	13,276	760,410	.....	.....	603,204
Tuolumne	5,798.86	119,873	1,793	1,119	2,352	.....	.....	121,318
Yuba	133,984.39	2,769,708	10,235	6,387	.....	.....	.....	2,776,090
	576,798.40	11,923,481	2,022,460	1,262,015	33,466,299	8,093,513	20,433,887	20,050,801

THE value of gold, silver, copper, lead and zinc produced at mines in California in 1926 was \$20,050,801, a decrease of \$3,233,553, or 14 percent, as compared with the value of these metals produced in 1925, according to statistics compiled by J. M. Hill, of the Bureau of Mines. There were decreased yields of 9 percent in gold, 40 percent in the value of silver, and 30 percent in the value of copper, but increases of 13 percent in the value of lead and 76 percent in the value of zinc produced, as compared with the values of these metals in 1925. There were 818 mines producing in 1926, of which 483 were placers and 335 were lode mines, as compared with 359 placers and 332 lode mines in 1925.

The production of gold in 1926 was 576,798.40 ounces, of which 252,923.99 ounces came from placer mines and 323,874.41 ounces from lode mines. Dredges produced about \$200,000 more gold than in 1925 and 95 percent of the total value of the output from placer mines in 1926.

The silver produced in 1926 was 2,022,460 ounces, valued at \$1,262,015, which is 1,031,956 ounces less in quantity and \$857,750 less in value than in 1925. This large decrease in yield of silver is due largely to the cessation of activities in September at the California Rand silver property, in San Bernardino County, though some exploratory work at that mine was carried on throughout the year. The silver produced from copper and lead ores was less than in 1925.

The production of copper in 1926 was 33,466,299 pounds, 13,398,614 pounds less than in 1925. The copper mines in Shasta County were closed, which reduced the copper output of the state materially. Plumas County copper mines also reduced their yield of copper, but copper mines in Calaveras County increased their yield.

The lead output in California in 1926 was 8,093,513 pounds, 1,527,313 pounds more than in 1925. Mines in Inyo and Los Angeles counties contributed largely to the lead output of the state.

Zinc produced by California mines in 1926 amounted to 20,433,887 pounds, valued at \$1,532,542, which is larger than the output in 1925 by 8,944,650 pounds in quantity and \$659,360 in value. Mines in Los Angeles and Shasta counties increased their zinc yield and zinc concentrates from these mines were exported to Belgium.

The average prices used for computing the values of the above metals are as follows: Gold, \$20.671835 a fine ounce; silver, \$0.624 a fine ounce; copper, \$0.14 a pound; lead, \$0.08 a pound; zinc, \$0.075 a pound.

STREAM POLLUTION

(Continued from page 606)

from all mines already abandoned.

What can be done in this general mine drainage situation? One facetious answer is that we might stop producing mine water by stopping coal production; seal up all the openings from which it is now coming, and have our streams

nearly as pure and free as they originally were, so far as this mine drainage is concerned. This would mean the total stoppage of production of at least 80 percent of the coal of the country, and possibly more, with its attendant reduction of industry of all kinds. Of course, this is impossible, as not even the most rabid advocate of pure streams wants such a solution. Another is to allow matters to go as they are, and even the most biased coal operator will admit that he would like to see an improvement in this respect, if reasonably practicable.

Any way we look at it, there is a real field for cooperation that will undoubtedly prove most beneficial as regards preventing further contamination of our water supplies by new sources and the best means of improving existing conditions. Recognizing the local nature of the problem, I particularly suggest cooperation between the units of your organization and coal operators and district associations of operators, along with the closest sort of a relationship between the Izaak Walton League of America and the National Coal Association. All of us are concerned about and interested in the welfare of America. My thought is that, inasmuch as this problem is essentially local in its character, and has its own peculiar angles the best way to approach it is through the units that operate in the respective localities. There is no general formula which can be laid down for the nation at large as regards the treatment of acid mine water. Conditions vary in every district as to the acid content of mine waters and the size of the streams into which the mine waters flow. The size of the streams and the quality thereof have a most important bearing on the subject. Every stream has a capacity to neutralize a portion of the substance carried thereto, whether those substances be the acidulous content of mine water or from other drainage. The maximum sewage absorption or carrying capacity varies with the stream.

Research is likely to find out why some mine water is acid, and some not, both coming from coal of approximately the same composition; whether by some method of mining the production of acid mine water can be decreased; whether the use of limestone rock dust in the mines for preventing explosions will tend to neutralize the acid in the water; whether there is any effective way of sealing up old workings to prevent the flow of water; some use for the iron oxide sludge formed if treatment is resorted to and where this sludge can be stored; and what the best methods of treatment are for the various conditions encountered; along with real information as to the probable cost thereof.

MINING IN ALASKA, 1926

MINERAL OUTPUT OF ALASKA, 1925 AND 1926

	Quantity, 1925	Value, 1925	Quantity, 1926	Value, 1926
Gold	307,679	\$6,360,281	324,450	\$6,707,000
Copper	73,855,298	10,361,336	67,778,000	9,489,000
Silver	698,259	482,495	690,000	430,500
Coal	82,568	404,617	86,000	452,000
Iron, metallic	13.8	15,980	8	10,400
Lead	789	140,571	778	124,400
Platinum metals			3,570	274,500
Miscellaneous mineral products, including petroleum, marble, gypsum, quicksilver,		455,412		170,000
		\$18,220,692		\$17,657,800

* Platinum for 1925 included in "Miscellaneous mineral products."

MINES in Alaska produced \$17,657,800 worth of minerals in 1926, as against \$18,220,692 in 1925, according to an announcement by the Geological Survey. The total value of the mineral output of the Territory since 1880 is \$571,000,000.

The table herewith shows in summary form the mineral output of Alaska for 1926, and, for the sake of comparison, the production of the same minerals in 1925. The most notable increases are shown both in quantity and value of the gold produced. There was some increase in the quantity of coal mined and sold. The production of lead showed practically no change, but owing to the generally lower market price that prevailed in 1926 the value of the lead produced in that year was somewhat less than in 1925. There was a considerable decrease in both the quantity and value of the copper produced and some decrease in the quantity and value of the silver, tin, and platinum metals. The output of most of the minerals here grouped under miscellaneous mineral products showed no notable change from the preceding year, though there is an apparent difference, because in the statistics for 1926 the platinum metals are shown separately, whereas in those for 1925 they are included in the miscellaneous group.

The decreases do not indicate any material lessening of mining activity in the Territory. In fact, the general mining outlook when analyzed on the basis of the number engaged in it is distinctly encouraging. Some of the reported decreases in production can be properly attributed directly to the lower prices for certain of the metals that prevailed during 1926. For example, the average price of silver, as computed by the Bureau of Mines, was about 7 cents an ounce less than in 1925. Copper was two-tenths of a cent less, and lead and palladium were also lower. A considerable falling off in the value of the mineral production of Alaska would have occurred under these conditions even if the same quantity of minerals had been mined. Obviously, however, a period of low prices for the metals is not one in which to stimulate production, so that in

such times a wise manager might well reduce the output of his mine as low as outstanding contracts, fixed charges, and other conditions would permit.

About 56 percent of the gold produced during 1926 came from placers, and of this amount nearly 61 percent was mined by dredges, of which there were

32 in operation in different parts of the Territory. This method of placer mining promises to yield even larger returns in succeeding years, because during 1926 several of the dredges were not operated through the entire season, owing either to time spent in completing them or to the extremely dry season that prevailed through most of Alaska, or from some purely local cause, and plans are already under way for building additional dredges at a number of places in the near future.

The foregoing facts are taken from a report on the mineral industry of Alaska in 1926, which is in preparation for publication by the Geological Survey. This report, in addition to the general facts set forth above, gives numerous details regarding the amounts of the different minerals produced and the places where they were mined.

GYPSUM MINED AND SOLD OR USED BY PRODUCERS IN 1926

THE gypsum industry in 1926 was not quite so productive as it was in 1925, according to a statement made public by the Bureau of Mines, based on reports received from 59 operators in 17 states and collected in cooperation with the Geological Surveys of Iowa, Kansas, Michigan, New York, Texas, and Virginia.

The quantity of gypsum mined in the United States in 1926 was 5,635,441 short tons, a decrease of 42,861 tons, or less than 1 percent, compared with 1925. This production, except for that of 1925, was the largest recorded and was twice as large as that of 1916.

The total value of the gypsum sold or used by producers was \$46,721,219, a decrease of \$856,021, or 2 percent, compared with 1925. This was the largest value recorded except that in 1925. The quantity of gypsum sold by producers without calcining in 1926 was 961,363 short tons, a decrease of 52,772 tons, or 5 percent, and was valued at \$2,509,885, or \$2.61 per ton; the quantity of calcined gypsum sold or used by producers

was 4,015,974 tons, a decrease of 80,383 tons, or 2 percent, and was valued at \$44,211,334, or \$11.01 per ton.

New York continues to be the largest producer of gypsum. The production of crude gypsum in that state in 1926 was 1,723,460 tons, a slight decrease from that of 1925. This was nearly one-third of the entire quantity mined in the United States and more than twice as large as that of the second State, Iowa. New York is also the largest seller of gypsum, marketing 328,086 tons without calcining, or 34 percent of the United States total, and 1,246,822 tons calcined, or 31 percent of the total. These figures represent a decrease of 7 percent in the uncalcined and an increase of 5 percent in the calcined gypsum compared with 1925. Other important states in the production of crude gypsum in 1926 were Iowa, 802,910 tons; Michigan, 659,685 tons; Texas, 533,156 tons; Ohio, 521,205 tons; Nevada, 350,972 tons, and Oklahoma, 324,021 tons. The first five of these states reported 75 percent of the total production.

GYPSUM MINED AND UNCALCINED AND CALCINED GYPSUM SOLD OR USED BY PRODUCERS IN THE UNITED STATES IN 1926, BY STATES

State	No. of active plants	Total quantity mined (short tons)	Sold or used by producers				Total Value
			Without calcining	Value	Calcined	Value	
Iowa	7	802,910	129,803	\$296,854	553,498	\$6,291,349	\$6,588,203
Kansas	8	195,440	47,641	108,792	111,174	1,111,928	1,220,720
Michigan	5	659,685	157,787	379,848	455,616	4,641,617	5,021,465
Nevada	5	350,972	52,642	102,252	218,670	1,424,953	1,527,205
New York	11	1,723,460	328,086	905,095	1,246,822	15,889,494	16,794,589
Ohio	3	521,205	13,082	38,788	509,522	6,758,433	6,797,221
Oklahoma	3	324,021					2,301,049
Texas	5	533,156					4,126,400
Utah	8	36,333					195,535
Other states†....	14	488,259	232,322	\$678,226	192,672	\$1,093,560	3,148,802
	59	5,635,441	961,363	2,509,885	4,015,974	44,211,334	46,721,219

* Included under "Other States." † Includes Arizona, California, Colorado, Montana, New Mexico, South Dakota, Virginia, and Wyoming. ‡ This figure includes also sales from Oklahoma, Texas and Utah.

UNITED STATES IMPORTS MOST OF ITS CHROMIUM

CHROMIUM is one of the few essential metals of which this country does not produce supplies sufficient for its economic needs, says the United States Bureau of Mines. Although this country is by far the largest consumer of this metal, domestic production is now practically negligible, while imports in 1926, exceeded 200,000 tons. Chromium is used in the making of chromium steels which possess great hardness combined with toughness. The metal is also a constituent of rustless steel, stainless steel, and other special alloys. It is of great importance in the chemical industries and is extensively used as a refractory. The United States possesses large reserves of low-grade, high-cost chromite, which would be sufficient to meet domestic needs for 6 or 7 years at the present rate of consumption, though a lowering of standard grades and a rise in price would both be necessary to bring about the mining of such reserves. Consumption and production of chromite in the United States clearly illustrate how an industry of considerable magnitude may depend entirely upon uncontrolled sources for its raw material. Chromite is but one of several metals that occupy a like position. In 1925 the United States required, to satisfy its trade demands, fully 60 percent of the world's production of chromite, 52 percent of that of tin, and 30 percent of that of antimony, although its production of each of these metals was negligible. It also required 25 percent of the world's production of mercury although it produced but 10 percent.

Chromium is commonly designated as a rare metal. Metallic chromium is crystalline and brittle, harder than glass, bluish-white in color, has a high metallic luster, and crystallizes in the cubic system. Chromium is not found as a native element but generally as chromite, the only chromium mineral now used commercially.

The only method in commercial use for the reduction of metallic chromium is the thermit process, which is based on the reaction between aluminum and chromic oxide. For the grades of material demanded by the trade three distinct metallurgical methods are in use. These are: the smelting of chromite in the electric furnace to produce ferrochrome; the manufacture of chromates and bichromates by the chemical treatment of chromite; the production of metallic chromium, by extracting chromium oxide from chromite, and reducing this oxide to metal by the thermit process.

Ordinary chrome steel contains about 2 percent chromium. In the manufacture of chrome steels, ferrochrome must be used because of the metallurgical difficulties, which add to the cost of making

these steels direct from chromiferous iron ore. Chrome steels can be bent cold, and can be welded to iron to form either a surface or a core that is extremely resistant to the attack of even the finest drilling tools. Chrome steels have many uses, including the manufacture of axles, springs, parts of gun carriages, automobiles, steel for safes, tires, cutlery steel, projectiles and armor plate. Steels intended to resist abrasive action are alloyed with vanadium, nickel, tungsten and manganese, in addition to chromium.

Rustless steel, commonly containing 13 to 14 percent chromium, is chiefly used in the manufacture of cutlery. An alloy known as stellite (essentially cobalt, chromium, and tungsten or molybdenum) is especially suitable for high-speed tools. Nichrome, an alloy of 60 percent nickel, 14 percent chromium and 15 percent iron, resists high temperatures and is used chiefly for annealing boxes and conveyor chains. Stainless steel, which contains 13 to 14 percent chromium, is used in the manufacture of exhaust valves, turbine blades, pump rods, rollers for bearings, in electric heating stoves, and in utensils.

Chromite is of great importance to the chemical industries. From it is obtained the chromium used for making chromates and bichromates. Chrome pigments—yellow, green and red—are widely used. In the dye industry the soluble chromates and bichromates are used as mordants. They are also used in the tanning of chrome leathers, and in the bleaching of fats and oils. In the ceramic industry the chromic acids and the bichromates are used to color pottery. The United States imports annually considerable quantities of these compounds.

The most important use of chromite as a refractory is as a liner for the open-hearth steel furnace. From a study made by its metal section, the War Industries Board estimated that 2½ pounds of chrome were utilized for every ton of steel manufactured. Chromite is used either as bricks or in irregular shapes as mined. Chrome bricks are used as a substitute for magnesite bricks, which are more costly.

Of the newer uses of chromium, one of the most interesting is for coating metals. In this country and abroad, the electrolytic plating of various metals with chromium is now on a commercial basis. The coating is hard and white, resembling platinum; it resists the action of ammonia fumes, hydrogen sulphite, and nitric acid, and is not attacked by molten zinc, tin or brass. It is said that chromium adheres more closely to the metal on which it is placed than does nickel, and a brilliant finish can be obtained without polishing. It is being increasingly used for automobile finish-

ing and for plating bearings. As chromium is not corroded by vegetable and fruit acids, it may possibly supplant tin for some purposes. The research work that has been done on chromium alloys for resisting corrosion and high temperatures bids fair to revolutionize some of the older industrial processes and to make new ones possible.

For the manufacture of certain steels there is no known substitute for chromium. In tanning also, no satisfactory substitute has been found. For pigments chromates may be replaced, but as a rule, to which the exceptions are few, the substitutes are more expensive. As a refractory in electric furnaces for making steel, chromium may be said to be interchangeable with magnesium. In steel furnaces operated at lower temperatures, chromite bricks may be replaced by magnesite bricks, but magnesite bricks are usually more expensive.

Present knowledge indicates that the world's major resources of chromite are in South Africa (Southern Rhodesia), New Caledonia, and western Asia Minor (Anatolia). In addition to the high-grade ore found in the countries mentioned, a large potential reserve of what is known as chromiferous iron ores, is found in Cuba, Celebes, the Gold Coast and Greece. These chromiferous iron ores contain a fraction of 1 percent to 3 percent chromium, associated with a small percentage of nickel. The Cuban deposits in the district of Mayari have been estimated to contain upward of 2,000,000,000 tons of such ore and those of the Celebes more than 1,400,000,000 tons.

Additional data are given in Information Circular 6038, "The Chromium situation from a Domestic Standpoint," by J. W. Furness, mining engineer, copies of which may be obtained from the United States Bureau of Mines, Department of Commerce, Washington, D. C.

TALC PRODUCTION IN 1926

THE total quantity of talc sold by producers in the United States in 1926 was 181,568 short tons, valued at \$2,110,994, according to figures compiled by the Bureau of Mines. The figures comprise 5,988 tons of crude talc, valued at \$26,723, 1,528 tons of sawed and manufactured talc, valued at \$130,253, and 174,052 tons of ground talc, valued at \$1,954,018. The total quantity was slightly less than in 1925, but the total value increased 5 percent. There were 21 producers of talc in 1926, two less than in 1925.

Imports of talc for consumption in 1926 were 23,846 short tons, valued at \$540,082. Corresponding figures for 1925 were 20,993 tons, valued at \$450,532.

SILVER, COPPER, LEAD, AND ZINC IN THE CENTRAL STATES IN 1926

The following statistics of silver, copper, lead, and zinc in the Central States in 1926, compiled for the Department of Commerce, by J. P. Dunlop, of the United States Bureau of Mines, give the production, value, tenor of ore, and average prices for the various states and for the large mining regions:

TENOR OF CRUDE LEAD AND ZINC ORE AND CONCENTRATES PRODUCED IN THE PRINCIPAL REGIONS OF THE CENTRAL STATES IN 1926

	Northern Illinois	Wisconsin	Southeastern Missouri	Southwestern Missouri	Kansas	Oklahoma
Total crude ore and tailings milled.....short tons..	245,100	1,440,300	6,261,600	1,025,500	4,717,500	10,934,000
Lead concentrates in crude ore.....percent..	0.15	0.16	4.80	0.60	0.81	0.86
Zinc concentrates in crude ore.....do.....	5.87	7.09	.....	4.76	5.12	4.95
Metal content of crude ore:						
Lead.....do.....	.11	.13	3.32	.38	.62	.65
Zinc.....do.....	1.38	2.38	.....	2.77	3.04	2.83
Average lead content of galena concentrates.....do.....	77.9	67.2	69.0	76.8	79.1	78.5
Average lead content of lead carbonate concentrates.....do.....	.....	.....	.....	60.0	60.0	.....
Average zinc content of sphalerite concentrates.....do.....	25.6	33.8	53.9	59.6	59.0	58.1
Average zinc content of silicate and carbonate.....do.....	.....	32.3	.....	39.5	.....	36.0
Average value per ton:						
Galena concentrates.....	\$104.02	\$93.02	\$93.98	\$106.68	\$104.92	\$106.95
Lead carbonate concentrates.....	.....	.....	.....	\$78.87	\$70.06	.....
Sphalerite concentrates.....	\$13.65	.....	\$43.82	\$49.01	\$48.03	\$45.91
Zinc silicates and carbonates.....	.....	\$25.05	.....	\$31.96	.....	\$25.18

The galena from southern Illinois (614 tons) had an average lead content of 64.2 percent, and that from Kentucky (76 tons) had 64.5 percent. Sphalerite from Kentucky had an average zinc content of 51 percent, and zinc carbonate concentrates (4,478 tons) had an average zinc content of 41.6 percent. Copper ore from Michigan amounted to 7,641,682 tons and yielded 1.15 percent of copper. The quantity of concentrates produced from the treatment of this ore was 272,365,636 pounds.

MINE PRODUCTION OF LEAD AND ZINC IN THE CENTRAL STATES IN 1926, BY REGIONS

Region	Short tons	Lead * Value	Short tons	Zinc † Value	Total value
Concentrates:					
Joplin.....	132,676	\$14,096,438	823,603	\$38,412,521	\$52,508,959
Southeastern Missouri.....	300,480	28,239,733	2,301	101,243	28,340,976
Upper Mississippi Valley.....	2,705	255,551	114,444	2,396,718	2,652,269
Kentucky and southern Illinois.....	690	63,921	5,060	133,888	197,809
Northern Arkansas.....	28	2,544	254	7,358	9,902
1926.....	436,579	42,668,187	945,662	41,053,728	\$3,711,913
1925.....	455,201	48,167,097	896,543	43,328,877	91,495,974
Metal:					
Joplin.....	102,117	16,338,720	423,800	63,570,000	79,908,720
Southeastern Missouri.....	203,062	32,489,920	1,092	163,800	32,653,720
Upper Mississippi Valley.....	1,810	291,040	29,377	4,406,550	4,697,590
Kentucky and southern Illinois.....	430	68,800	1,838	275,700	344,500
Northern Arkansas.....	18	2,880	87	13,050	15,930
1926.....	307,446	49,191,360	456,194	68,429,100	117,620,460
1925.....	317,375	55,223,250	440,369	66,936,088	122,159,338

* Includes both galena and a small quantity of lead carbonate concentrates.

† Includes sphalerite and a small quantity of zinc carbonate and zinc silicate concentrates.

‡ Includes Iowa, northern Illinois, and Wisconsin.

MINE PRODUCTION OF RECOVERABLE SILVER, COPPER, LEAD, AND ZINC IN THE CENTRAL STATES IN 1926, BY STATES

State	Fine ounces	Silver Value	Pounds	Copper Value
Illinois.....	2,990	\$1,866	.....	.....
Michigan.....	105,242	65,671	175,381,565	\$24,553,410
Missouri.....	90,000	56,160	1,077,000	150,780
1926.....	198,232	128,697	176,458,565	24,704,199
1925.....	228,957	158,896	155,169,588	22,034,081

State	Short tons	Lead Value	Short tons	Zinc Value	Total value
Arkansas.....	18	\$2,880	87	\$13,050	\$15,930
Illinois.....	655	104,800	2,577	386,550	493,216
Kansas.....	28,463	4,554,080	126,307	18,946,050	23,500,130
Kentucky.....	48	7,680	1,838	275,700	283,380
Michigan.....	.....	.....	.....	.....	24,619,090
Missouri.....	207,012	33,121,920	26,018	3,902,700	37,231,560
Oklahoma.....	69,704	11,152,640	272,567	40,885,050	52,037,690
Wisconsin.....	1,546	247,360	26,809	4,020,000	4,267,360
1926.....	307,446	49,191,360	456,194	68,429,100	142,448,356
1925.....	317,375	55,223,250	440,369	66,936,088	144,352,315

Value computed at the following average prices for 1926: Silver, \$0.624 per ounce; copper, \$0.14 per pound; lead, \$0.08 per pound; zinc, \$0.075 per pound.

CARBON BLACK PRODUCTION

THE production of carbon black from natural gas in 1926 was 180,576,176 pounds, valued at the plants at \$9,939,221, according to G. R. Hopkins, of the United States Bureau of Mines. This represents an increase in production over 1925 of 3,158,798 pounds, or 2 percent, which was, however, insufficient to eclipse the record figure of 186,872,034 pounds established in 1924. Stocks at the plants December 31, 1926, amounted

to 108,378,101 pounds, an increase of 12,354,653 pounds, or 13 percent, over the preceding year. Losses at the plants in 1926 totaled a little over 700,000 pounds, or about half what they were in 1925.

The production minus the addition to stocks and losses gives total deliveries or sales for 1926 as 167,504,710 pounds as compared with 175,631,326 pounds in 1925, a decrease of 8,126,616 pounds, or 5 percent. This is the first time since carbon black statistics have been com-

pared that total sales have shown a decrease.

The distribution of carbon black deliveries among industries in 1925, as determined by a survey only recently completed, was as follows:

	Pounds	Percent
Rubber.....	86,329,000	49.2
Export.....	43,183,000	24.6
Ink.....	22,389,000	12.7
Paint.....	11,757,000	6.7
Miscellaneous.....	11,973,000	6.8
	175,631,000	100.0

The channel process remained by far the most important method of manufacturing carbon black, producing 152,300,410 pounds in 1926 as compared with 28,275,766 pounds by the other processes.

Exports of carbon black in 1926 amounted to 39,210,389 pounds as compared with 43,182,635 pounds in 1925. The 1926 exports had an average value of 9.2 cents as compared with 8.2 cents in 1925. The United Kingdom was our leading carbon black customer in 1926, followed in order by France, Canada, and Germany. Of these four countries France showed the greatest increase over 1925.

Louisiana remained the outstanding producing state, its output in 1926 of over 130,000,000 pounds comprising 72 percent of the total for the country. West Virginia produced 3,804,586 pounds of carbon black in 1926, a decline of 7,043,208 pounds, or 65 percent, from 1925. This state, once the leader in the industry, is now producing only 15 percent of its output of six years ago and only 2 percent of the output of the country. Carbon black manufacture at present prices is dependent on cheap gas, of which there is little left in West Virginia. Texas showed the greatest gain in production of any of the states, its output amounting to 36,328,052 pounds as against 26,219,510 pounds in 1925, a gain of 39 percent.

NEW GEOLOGICAL REPORT OF LEADVILLE

MINING men and others will be interested in a Geological Survey volume just issued by the Interior Department describing the mineral development and the geology of the great Leadville mining district of Colorado—Professional Paper 148.

During 1859 the great "Pikes Peak Excitement" lured a continuous stream of emigrants westward, and while many of those whose wagons carried the triumphant device "Pikes Peak or Bust" returned later with the device significantly altered to "Busted," the more adventurous and hardy pioneers pushed resolutely up through the rocky gorges toward the sources of the streams. A few of them, early in 1860, found placer gold in the bed of California Gulch, which bounds the present city of Leadville on the south. In spite of the difficulties of communication in this wild region, news of the discovery spread with amazing rapidity, and by July there were about 10,000 people in the camp. It is said that \$2,000,000 worth of gold was taken out during this first summer. The peak of production was soon reached, however, and after the first year the population of this new district, then known as Oro City, rapidly decreased.

VAST FORTUNES OVERLOOKED

Lead carbonate with a high content of silver is said to have been found in the gold-bearing gravel as early as 1861, but was only a source of annoyance, because it could not be readily separated from gold in the sluice boxes. In 1868 the first vein was discovered and produced gold, which was found in nests of lead carbonate. This and one or two other veins imparted a fitful prosperity to the district, which seemed to be one of the many small and insignificant producers of gold that abound in the Western States. And in 1874 Oro City was almost deserted, and the site of the present city of Leadville was an unknown wilderness.

If it had not been for the extensive experience of two men equipped with technical skill, it is quite probable that the region would soon have been entirely abandoned and the great bodies of silver-lead ore would have remained securely concealed to await the chance discovery of some future generation. These men, struck by the appearance of the "heavy rock" that annoyed the placer miners, identified it as silver-bearing lead carbonate and quietly prospected the wooded slopes that bordered the gulch. The first lead carbonate in place was found on Dome Hill in 1874, but none was mined until 1876. Production increased rapidly and in 1880 amounted to more than 66,000,000 pounds of lead and nearly 10,000,000 ounces of silver.

GEOLOGIST STUDIED DISTRICT 45 YEARS AGO

In 1880 one of the first undertakings of the newly organized United States Geological Survey was a study of the Leadville mining district. S. F. Emmons was placed in charge of this work, and his preliminary report on the district was issued in 1882. His complete report, which involved a vast amount of laboratory work and preparation of very detailed maps, was issued in 1886. It was known as the Leadville monograph and immediately gained recognition as a classic and as marking a new epoch in

the science of mining geology. During the 40 years of intensive mining in the district that have elapsed since its publication, this monograph and its map have been a constant well of information to mining engineers and geologists, and especially to local companies, who have called it their miner's Bible.

Mining developments in the district grew so rapidly that Emmons, on revisiting the district after some years, realized the need of a supplementary report, and a little later decided that the extent of developments and the vast amount of data available justified a complete resurvey. He planned accordingly, but his administrative duties were so many that his progress with the resurvey was slow. In 1907 he wrote a bulletin on the "Downtown" area. This area had been discovered and developed since the issue of his monograph and maps, which were of much aid in the direction of this new work.

By 1911 he had made a great deal of progress with the resurvey, but had made only rough fragmentary drafts of parts of his report when he died. It devolved upon Prof. John D. Irving, of Yale University, who had been Emmons' assistant during much of the resurvey, to carry on the work, but Irving's duties at Yale required the major part of his time, and continued developments in the district made it increasingly difficult to complete the report. A rough draft of most of the report, however, had been made by 1917, before Irving left with the American Expeditionary Forces for France, where he lost his life.

The work was then taken up by G. F. Loughlin, who had studied the newly discovered deposits of zinc carbonate in 1913 and had submitted a report on them. Further field studies were necessary as late as 1925 before the report was completed.

NAME LEADVILLE A MISNOMER

After the issue of the original monograph in 1886, important discoveries of lode gold were made about 1890, of zinc sulphide about 1897, and of zinc carbonate in 1911. In spite of the name Leadville, lead has never been preeminent in value in the district's output. After the millions of gold had been taken out silver was the big product until 1903, when it was surpassed by zinc, which has exceeded all the other metals ever since, except in 1922 and 1923, when the zinc market was very dull, and silver became the ranking metal in value. Copper and manganese have contributed annually to the total production, and small amounts of bismuth have been produced intermittently.

Leadville has been hard hit at different times by miners' strikes and industrial depressions, but its most severe depression has been since the World War. Dull markets, coupled with labor troubles, caused the closing and flooding of some of the most productive mines, which have been reopened only after long, expensive campaigns of unwatering. It is also quite unlikely that such an old district, which has been so thoroughly prospected and has produced a total value of more than \$435,000,000 to the end of 1926, will again attain production figures comparable with those of its most prosperous years, but study of the local mining geology leaves the conviction that, besides the vast amounts of mixed sulphide ore that have been

awaiting profitable methods of treatment, considerable quantities of ore remain to be discovered within the heart of the district, and some of the outlying territory is worthy of careful attention.

As mining developments have progressed, geology has become increasingly important in the finding of ore. The new report on the geology and ore deposits of the Leadville district, published as Professional Paper 148 of the Geological Survey, contains a detailed account of the stratigraphic and structural geology, the history of mining developments, statistics of production, mineralogy, character, and origin of the ore deposits, and factors controlling their distribution and closes with a chapter on ore reserves. It is accompanied by a number of large-scale geologic maps of different parts of the district.

A short report, omitting detailed descriptions and containing only a few illustrations, was issued a year ago as Bulletin 779, entitled "Guides to ore in the Leadville district, Colorado." This short report is recommended to those interested in ore hunting but not necessarily in the geology of the district.

Professional Paper 148 and Bulletin 779 may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for \$2.50 and 35 cents, respectively.

TAXATION OF AMERICAN BUSINESS IN EUROPE

(Continued from page 593)

Adams, studied these resolutions at the Brussels Congress of the International Chamber of Commerce.

In May, 1926, a meeting was called in Geneva of experts officially representing Belgium, Czechoslovakia, France, Germany, Great Britain, Italy, Japan, the Netherlands, Poland, Switzerland and Venezuela. They made preliminary drafts of type conventions for the purpose of giving effect to the principles agreed upon. The meeting adjourned in order that its members might give thorough consideration to the preliminary drafts. Another meeting was held recently in London at which the United States was represented by Dr. T. S. Adams. It is expected that final form will be given to the type conventions which are to serve as models for bilateral agreements between interested countries. Until now, the majority of the experts have favored the system of classifying taxes as real or impersonal taxes on the one hand, and personal taxes on the other. The real tax is to be levied on business profits, salaries, and as a rule on interest and dividends, by the country of origin. The personal tax, like the French general income tax is, in principle, to be imposed on all kinds of income by the state where the recipient of the income has his domicile. It may be noted that the prior right to tax the most important kinds of income is given, in general, to the country where they arise.

PRECIPITATION OF LEAD AND COPPER FROM SOLUTION ON SPONGE IRON¹

THE Bureau of Mines in its investigation on manufacture and utilization of sponge iron, has conducted, in cooperation with mine operators in the West, a large amount of experimental work on the precipitation of lead and copper from leach solutions by use of sponge iron as a precipitant. The work on lead solutions was conducted by the Intermountain Experiment Station at Salt Lake City, Utah, and that on copper by the Southwest Station at Tucson, Ariz. In these experiments laboratory size apparatus was developed in which complete precipitation of lead, and also of copper, at a rapid rate was attained. The results of these experiments are briefly described in this report. A more complete report will be issued in the future by the Bureau of Mines.

OBJECT OF EXPERIMENTS

As sponge iron is much like porous, coarse sand, it is a very tempting material to use as a precipitant of metals, in place of coarse scrap iron, which in comparison is awkward to handle and exposes only a small amount of surface to pregnant liquors. The following experiments are largely a record of the behavior of sponge iron as a precipitant of lead and copper, under laboratory conditions, comparable to those that would be present in a commercial plant in attempting to obtain maximum contact of surface between solution and precipitant. Physically, the study is largely one of the rates of diffusion of the metal ions in the solutions, and through the metallic coatings surrounding the sponge-iron particles. The practical objectives are to remove completely the valuable metals from solution, and at the same time obtain a precipitate of good grade. In order to fulfill this latter requirement, the precipitant should be almost completely consumed. These practical ends are usually attained by having the two substances involved pass each other counter-currently; that is, in such a manner as to have the strongest precipitant in contact with the most impoverished solution, and vice versa.

EXPERIMENTS WITH LEAD SOLUTIONS

In nearly all methods involving the leaching of lead from its ores, this metal has been dissolved into solution as the chloride, and concentrated liquors have been employed. The solubility of lead under such conditions is comparatively small at best; the hot pregnant liquors from which the metal is to be precipitated are nearly saturated with respect to lead. Only a very small amount of acid is used. Therefore, there was no need to learn the behavior of the sponge iron in precipitating lead from solutions of widely differing composition, but rather to learn under what conditions, and with what mechanisms, this precipitation might be most readily carried out.

An historical sketch was accordingly prepared, with a sufficient number of references to enable an investigator to

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VIRGIL MILLER,‡ AND W. A. SLOAN§

familiarize himself with past practice. Then a series of experiments were conducted, with quantitative results, so that the future designer might obtain ideas as to what specifications had to be met in order to satisfy the physical and chemical properties of the lead on precipitating it in apparatus of varying types.

It was found that the solutions should be heated to 60° C. in order to precipitate the lead in less than an hour, if the solution were stirred vigorously. Solutions colder than this, however, would not usually be employed in plant operation. It was learned that the sponge-iron particles more thickly coated with lead would "ball" if stirred too vigorously. The presence of more than five times the quantity of iron required chemically to replace the lead had very little effect on shortening the time needed for complete precipitation, although the particles poorer in lead did not have this tendency to unite. The rate of precipitation varied directly as the amount of lead left in solution, when the amount of iron added was just that required stoichiometrically to replace the lead.

In order to avoid the agglomeration of the lead-coated sponge-iron particles that is caused by stirring, pregnant lead liquors were percolated upward or downward through beds of sponge iron. It was found that only thin beds could be employed, if the iron were to be nearly all utilized, as the precipitated lead occupies more volume than did the iron, and thus made the bed impervious to the passage of solutions. It was found possible to precipitate all the lead from solution by having a large excess of sponge iron present, but enrichment of this precipitate by subsequent exposure to an excess of fresh rich solution was difficult. A maximum exposure of 10 hours was required for the iron inside the lead-coated particles to become completely replaced. Porous and pure varieties of sponge iron were found to react much faster than those having the opposite qualities. Attempts to utilize beds of sponge iron a few inches thick by giving them freer opportunity to expand in V-shaped receptacles were unsuccessful.

Attempts were made to so separate the particles that they would not agglomerate even when a rapid rate of diffusion was given the liquor by various forms of mechanical stirring. Dropping the iron into the solution in V-launders feeding a slowly operated stirring tank, and the use of ribbed or plain drums was found to "ball" the precipitate. The sponge iron was found to oxidize rapidly when agitated in the solution by blowing air through a porous diaphragm.

It was finally found that freedom from "balling" could be insured by slowly rabbling sponge iron downward over a series of superimposed trays placed in a cylindrical tank, and allowing the pregnant solution to flow upward counter-currently against the passage of the iron. Products containing more than 80 percent lead were made, while at the same time the liquors running from the machine were barren of lead. This type of apparatus was then tried with com-

mercial solutions and found to operate successfully.

EXPERIMENTS WITH COPPER SOLUTIONS

Copper-sulphate solutions have been used containing widely differing amounts of copper and acid. The use of iron as a precipitant for copper is very old, and machines of many types have been employed. For these reasons, in contrast to the work on lead, the chief interest lay in learning the behavior of copper on precipitating from various solutions. Afterwards several types of mechanism were noted in which it would be feasible to carry out the precipitation by sponge iron, and experiments were made using one apparatus.

The behavior of sponge iron made from various ores and by different processes was compared. In regard to the amount of iron that should be used, it was found that an excess of 7.5 percent of metallic iron over that required stoichiometrically to precipitate the copper was usually sufficient, and that there was but little advantage to be gained by adding an excess of over 15 percent. Whether the sponge iron was added in stages or all at the start made little difference.

The temperature increased very rapidly on precipitating the copper, and was difficult to control, as often over 80 percent of the metal was replaced from solution in two to four minutes. As the rate of precipitation increased sharply with increase of temperature, a carefully standardized procedure was needed to give comparable results.

The content of the solution in both copper and acid affected the rate of precipitation. An increase in acidity decreased the rate of copper precipitation in the richer copper solutions, but increased it in the poorer solutions, when the amount of sponge iron present was 7.5 percent in excess of the chemical equivalent. On computing the solubility of the metallic iron of the sponge iron in the presence of acid and copper, it was found that the amount of metallic iron dissolved increased with an increase in acidity for the richer copper solution, and decreased with an increase in acidity for the solutions that were poorer in copper. There was evidently an interrelationship between the rate of dissolving of the iron and the rate of precipitation of the copper. (The rate of dissolving of the sponge iron varied considerably with the kind of iron used.)

The measurement of the rate of precipitation of the copper was again rendered difficult by the fact that the copper precipitated was the difference between the amount that had been chemically replaced by the iron and that which had been dissolved. The rate of dissolving of pure copper in pure sulphuric acid solutions in the presence of air was examined, as were also the effect of the addition of ferrous sulphate, and of the exclusion of air. The amount of copper dissolved by acid with the air excluded was practically nothing. When air was admitted, the addition of ferrous sulphate slowed down the rate of dissolving from what it was with acid alone.

It was concluded that the dissolving was due to the direct atmospheric oxidation of metallic copper, with the subsequent dissolving (Continued on page 622)

¹ U. S. Bureau of Mines Information Circular.
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* Williams, C. E., and others, The Production of Sponge Iron, Bull. 273, 1927. (In course of publication.)

FLOTATION OF OXIDIZED ORES

SEVERAL of the most important mining companies in the western part of the United States and in Mexico are now operating flotation plants for treating oxidized ores, although the treatment of oxides by flotation was in its infancy as recently as 10 years ago, points out the United States Bureau of Mines.

Oxidized ores may be considered as ore whose components have undergone a change in chemical composition by natural weathering, usually from the sulphide form, states Thomas Varley, formerly superintendent of the Intermountain Experiment Station of the Bureau of Mines, in a report just issued. The decomposition of minerals and changes in chemical components depend on the conditions and agencies involved. In weathering under common conditions, the sulphides oxidize to sulphates, and, in turn, over long periods of time, under the influence of other agencies, the sulphates may change to carbonates and oxides—which ever may be the most stable form under existing circumstances. Thus in a deposit of oxidized ores there may be all gradations in transformation of minerals, from true sulphides to true oxides. Under more unusual chemical conditions, rarer compounds may be formed.

In comparing the flotation of oxidized ores in plant practice, with the flotation of the sulphides, it appears that the former has borrowed the new reagents developed largely in the flotation of sulphides, and to these now adds sodium sulphide as almost the only sulphidizing agent. There is still a tendency to use the heavier oils and tars to a greater extent than the latest practice for sulphide ores would deem feasible. The special reagents for oxidized ores developed in the various laboratories, as indicated by flotation patents, do not appear as yet to have been widely adopted in plant practice. However, special frothing "oils" are used in some plants. Sodium silicate is used to some extent, probably to assist in excluding the slime present in most oxidized ores.

A large tonnage of oxidized ore is being smelted directly. The economy of continuing this practice will depend largely on the balance between iron and silica in the smelter charges, as well as on the improvements in the art of floating oxidized ore itself. The amount of iron present, in turn, will depend largely upon developments in the concentration of the sulphide ores.

In looking over the developments in the flotation of oxidized ores since a fair start was obtained, say, about 1916, the Bureau of Mines feels that, although new reagents have been tried, the percentage of the oxidized material recovered in usual plant practice has not

greatly increased. The growth, it would be felt, is more an increase in tonnage treated than in percentage of metals recovered. For the greater part, in plant practice the developments in the flotation of sulphide ores have been followed rather than new developments found by research work on the oxidized ores, and the oxidized valuable minerals themselves.

The extent to which rarer minerals of oxidized ores occur, other than those commonly known, has not, perhaps, received due consideration. Since the chemistry and mechanism of sulphidizing lead carbonate, for instance, appears to be relatively exact, failure to secure high recoveries when treating an oxidized lead ore by sulphidizing and flotation may be taken as an indication that the ore contains constituents that are either not sulphidized at all or to such a slight extent as to have little effect on their floatability.

Comparatively little is known regarding the possibilities of sulphidizing many of the oxidized minerals, and, what is perhaps a more pertinent fact, the content of these minerals in oxidized ores from various localities. Knowledge of this character is essential to intelligent treatment of any ore, and can be acquired only by intensive study and the utilization of the correct methods of procedure.

Work done at the United States Bureau of Mines Experiment Station, Salt Lake City, on pure sulphide minerals has been productive of fundamental data on the mechanism of some of the commoner reagents used in flotation. In so far as is known, little or no work of a similar character has been applied to ascertaining the effect of sulphidizing or other treatment of the various pure oxidized minerals.

The extent to which difficulties are encountered in the treatment of oxidized ores is reflected by mineral loss in the final tailing. It is logical to investigate this product thoroughly in order to ascertain the form of the lost mineral, and also whether the mineral loss is due to a coating of foreign material, such as iron oxide and clay, or of some alteration product of the mineral itself that isolates the valuable material from contact with the reagents. Also when any reagents are added that seem to be promising for chemical reasons, a good idea may be obtained from close study as to why they do or do not function as expected. For instance, in the filming of a mineral, it may be learned whether the film does not form or whether it does not adhere after it is formed. Reasoning from chemical or physical hypotheses may indicate the proper procedure to obtain a sufficiently stable film to enable the mineral to float.

Further details are given in Serial 2811, "The Flotation of Oxidized Ores," copies of which may be obtained from the United States Bureau of Mines, Department of Commerce, Washington, D. C.

PRECIPITATION OF LEAD AND COPPER

(Continued from page 621)

of the oxide in sulphuric acid, rather than through the agency of ferric salts. The air was sucked in by the rapidly rotating impellers, during the precipitation, the quantity of air dissolved in the original solution being negligible.

When a constant amount of metallic cement copper was added to a solution agitated in an open beaker, the more acidic the solution, the greater was the percentage of copper dissolved. With a constant ratio of three parts of metallic copper to two parts of acid, increasing the acidity of the solution increased the number of grams of copper dissolved, but in general decreased the percentage precipitated of the total copper present. The number of grams of copper dissolved per minute for a given percentage of acid was also approximately constant up to the time all the acid was neutralized. With this same 3 to 2 ratio between copper and acid, the fastest rate of dissolving of the copper was at an acid content of between 10 and 16 grams per liter. The amount of air admitted and the size of the bubbles were found to influence greatly the rate of dissolving of the copper.

All of the above data were applicable to the design of machines in which the copper could be precipitated by batch methods, with some few additional data on rates of settling. Where the resolution of the copper on account of the admission of air was not serious, the metal could be nearly completely precipitated in 15 to 25 minutes with an amount of sponge iron 7.5 percent in excess of the theoretical equivalent.

The great difficulty in designing a continuous precipitation system is to obtain countercurrent passage of the precipitant and solution. A scheme involving alternate agitators and thickeners was suggested, along with other plans. Any design involves a compromise in the time spent for agitation to insure close contact between the solution and the precipitant, and that spent for settling the partly used sponge iron plus precipitated metal from the solution, to effect the countercurrent passage of the two. In the precipitator that has a series of horizontal trays over which the sponge iron was rabbled downward, and over which the solution ascended, for the work on lead the compromise was all in favor of settling to make the metals go downward, since the solution could not be agitated violently on account of "balling" the lead.

The same type of multiple-tray precipitator was tried for the precipitation of the copper. It was found that the capacity of the apparatus could be fixed at a constant volume of liquor for solutions containing more copper than, say, 0.5 percent. The machine operated satisfactorily mechanically, but modifications to the design were suggested, to afford better contact between the sponge iron and the solution. As the sponge copper does not "ball," it may be kept in suspension by agitation. The rate of settling of all of the copper except a little "float" is rapid.

TIMBERING ALONG THE ROBBING LINE—FACTORS INFLUENCING FALLS OF ROOF IN COAL MINES

By J. W. PAUL*

SOME roof material, such as shale, has a tendency to bend before breaking, and some material, such as limestone and sandstone, tends to bend very little before breaking. Where the coal is removed in pillar extraction the roof breaks or it depresses either through a bending action or through the pillars crushing, or if the bottom is soft material the floor may heave. Unless the roof breaks, all these forces bring weight on the roof supports and ultimately result in breaking or crushing them. It would appear under these conditions that the types of supports used should be so designed that they will not break under the preliminary load resulting from the first movement of the roof. This desirable result, in part, may be accomplished by the use of caps on the props, by the use of tapered props, or by specially designed props such as the Sarre. The proper size of caps to use can be determined only by experience. The cap should be the full width of the top of the prop, be not less than 12 inches long, and thick enough to admit of the prop becoming imbedded in the cap before the prop will break. Props that have been tapered at the top or at the foot have been found to give good service in longwall work since the tapered end will burr under loads that do not break the prop. A type of metal prop that is being used in some European mines, and is known as the Sarre prop, consists of two H or I steel members held together by iron links and wooden wedges. These props will yield at the joint and decrease in length as the weight increases by the depression of the roof; this type of prop, on account of its cost, is expected to be recovered after it has served its purpose.

ROOF STRESSES

Stresses in the roof material and the coal may be in equilibrium before the coal is mined, but the removal of the coal destroys this equilibrium and in the effort made to reestablish a state of equilibrium there will be movement which results in cracks and breaks in the roof strata. Some material, such as flexible shale and coal, will yield before falling. This phenomenon is very pronounced with some shale or slate and coal roofs which throw off spalls or small pieces while this movement is in progress, and ample time is given for the retreat of the miner who may observe the falling of the spalls or small pieces. The harder rocks, such as sandstone and limestone, being of an inflexible nature, may break with little or no yielding or warning to the miner.

The action of the roof along the robbing line is different from that of the roof in solid work. In solid work in entries and rooms, as a rule, only the immediate roof material is the source of falls, the weight of the main roof being carried by the pillars, but in robbing

work and in long or shortwall work the stability of the immediate roof is affected by the action of the main roof which ordinarily can not be held in place by the use of timber supports. As the coal is removed along the robbing line and at the face of long or shortwall work, the main roof begins to subside, often with a crushing effect on the coal pillars, and its movement causes cracks to appear in the immediate roof. Thus weakened, the immediate roof in the working zone is likely to fall and cause accidents unless it is properly and adequately held up with timber which yields without breaking under the preliminary load.

The direction and length and the regularity of the break line are contributing factors to roof movement, and have their influence on falls which may occur at places where men are engaged at work.

Where the main roof is mostly strong shale, sudden collapse of the immediate roof is not so probable as where strong sandstone or limestone compose the material of the main roof. With a roof that is irregular in coming down as the robbing line retreats, there is greater danger of falls of the immediate roof in the zone where men may be engaged in the robbing work.

The room-and-pillar method that gives most promise of increased safety against falls is the use of narrow rooms and wide pillars. Where wide rooms and narrow pillars are used, the main roof is often disturbed by the first or advance work, and if the main roof begins to move in the first mining it makes pillar recovery increasingly dangerous and much loss of pillar coal results. It, therefore, may be seen that the question of protection against falls of roof and sides is materially influenced by the method of mining practiced.

Timbering along the robbing line should always consist of posts with cap pieces, and when the roof is scaly or cut by cracks or slips crossbars should be used, and under some roof conditions forepoling or use of timber cribs will be found necessary to insure the safety of the workmen. Caution, "telltale" or "talking" props should always be set near the end of the pillar which will give warning of roof movement.

The immediate roof along the robbing line in many mines may be caused to break at prearranged places by placing props in rows, two or three rows being used for this purpose, and having substantial caps placed parallel to the line of fracture, or timber cribs may be used to good purpose in this work.

In pillar work, where the same amount of thought is given to the safety of the workmen as is given to the recovery of the coal, some system of roof support can usually be found that will give the maximum protection to the workmen, and such a system is possible of development by a careful study of the local conditions, guided by a knowledge of engineering principles and practical experience in mining.—*Information Circular, Bureau of Mines, Department of Commerce.*

METHODS PURSUED IN FLOTATION OF OXIDIZED ORES

IN summarizing the operations of a number of important mining companies in the United States now operating flotation plants for treating oxidized ores, the Federal Bureau of Mines points out that most operators pay considerable attention to the alkalinity of the pulp. Excess lime seems to have considerable effect upon the flotation conditions. The alkalinity is usually kept from 9 to 13 grains per United States gallon. Some of the operators use ferrous sulphate to reduce and control the alkalinity of the pulps. Other reagents where the sulphate radical can readily be utilized could be used. The pulp densities are usually kept about 25 percent solids. They vary, however, in some cases from 20 to 28 percent solids.

Practically all of the plants crush the ore to all pass a 65-mesh screen. Most of them crush to about 95 percent through 100-mesh and 60 percent through 200-mesh.

The common sulphidizing agent is sodium sulphide of the commercial grade. This varies in quantities from one to five pounds, commonly used in amounts proportional to the amount of material to be sulphidized. Calcium polysulphide has been used in some cases, but its use has been reported as being discontinued. The method of adding the sodium sulphide varies greatly. Some prefer to add the material to the ball mills or other grinding medium while others add in solution form at different points in the flow line. It is generally conceded, however, that the reagent should have some little time to act upon the ore before being passed to the flotation circuits. This time may be arrived at by some experimental work.

Most operators use a relative crude oil in small amounts which seems to stabilize the froth. Sodium silicate is added in some cases. It seems to assist the sodium sulphide somewhat, for the plants reporting its use also report the use of smaller quantities of sodium sulphide. Xanthate seems to steady and balance the flotation froth. However, some of the plants do not use this reagent. Reconstructed oils of various kinds are made. In most cases they are used especially to assist in the silver recoveries. Thiocarbanalid seems to improve the silver recovery in some cases.

Cresylic acid, hardwood creosote, and pine oil seem to be used mostly as frothing agents. Refined coal-tar products are used at some plants in place of the other frothing agents.

While it would be difficult to forecast any reagent that might be best suited to a particular ore, it might be well for experimentors to try the oils and reagents which are in common use, for this particular type of flotation.

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EFFECTIVE ROCK-DUSTING OF COAL MINES¹

Discussion Of Causes For Apparent Failures—General Rules For Secondary Defense—Factors Controlling Explosibility of Coal Dust—Non-Combustible Content Of Dust Should Always Exceed Sixty-five Percent

BUREAU OF MINES POLICY ON ROCK-DUSTING

"To prevent the propagation of mine explosions, the Bureau of Mines, Department of Commerce, recommends rock-dusting in all coal mines, except anthracite mines, in every part, whether in damp or dry condition. It also recommends that rock-dust barriers be used to sectionalize the mine as additional defense; but these should not be regarded as a substitute for generalized rock-dusting." (Mine safety decision, No. 5, April 7, 1927.)

PURPOSE OF THIS CIRCULAR

The purposes of this circular are to present concisely the requirements for effective rock-dusting of coal mines in order to prevent propagation of mine explosions, and to point out the principal related facts on explosibility of coal dusts and mixed coal-mine dusts, as determined by extensive testing in the Experimental Mine of the Bureau of Mines. Study of these principal facts on coal-dust explosibility in conjunction with the recommendations for rock-dusting, should help to make clear to mine operators and others concerned the necessity for systematic rock-dusting in all coal mines except anthracite mines, and the futility of inadequate or sporadic rock dusting.

The descriptions of nearly 1,000 explosion tests in the Experimental Mine are available in a forthcoming bulletin² and in earlier publications.³

For detailed specifications as to the kind of rock-dust, amount to use, where to be applied, and method of sampling and testing, the reader is referred to Bureau of Mines Serial 2606,⁴ and American Engineering Standards Committee "Recommended American Practice for Rock-Dusting Coal Mines," quoted in Bureau of Mines Information Circular No. 6030.⁵

SUMMARY OF SPECIFICATIONS FOR ROCK-DUSTING

1. *Mines to be rock-dusted.* All coal mines, except anthracite mines, should be rock-dusted.

2. *Extent of rock-dusting.* All open, accessible parts of a coal mine should be rock-dusted, including slopes, entries, cross-cuts, and rooms, headings and pillar workings to within at least 50 feet of the face.

3. *Amount of rock-dusting.* After cleaning up the coal dust as thoroughly as practicable, sufficient rock-dust should be used to have the mixture of remaining coal-dust plus the rock-dust in any

zone contain 65 percent or more of inert or non-combustible matter. First dusting may require 3 pounds to 5 pounds per linear foot of passageway.

4. *When to rock-dust.* In any zone or section (made by dividing the mine for rock-dusting purposes) when the incombustible content falls to 55 percent, that section should be re-rock-dusted so as to bring the incombustible content well above 65 percent.

5. *Kind of rock-dust.* An incombustible dust, which is not unduly absorbent of moisture or which does not have a tendency to pack, should be used. Rock-dust for generalized dusting should not contain more than 25 percent free silica. This provision is not essential for barriers, for which purpose a non-moisture absorbing non-packing dust is particularly advisable. Rock-dust should not contain more than 2 or 3 percent of combustible material.

Limestone and dolomite dusts are preferential rock-dusting material, as they are free from silica and are whitish in color. Their light color is in great contrast to the blackness of coal dust, and discloses to the eye when there are dangerous accumulations of coal dust. A further advantage of light color is the aid to illumination.

6. *Size of rock-dust.* It should all pass through a 20-mesh sieve and at least 50 percent through a 200-mesh sieve.

7. *Sampling of rock-dust* in defined zones of the mine should be done systematically and regularly. A minimum of 20 samples should be gathered monthly in a mine of small size and more samples in larger mines. It is recommended that at least one sample for each 1,000 tons of coal produced should be taken.

8. *Determinations of the non-combustible content* may be made by the Bureau of Mines "volumeter" checked by occasional chemical analysis.

9. *Records of analyses or determinations* in specified zones should be made in a book kept for the purpose and the times of re-rock-dusting each zone. Maps for rock-dusting purposes should be maintained and posted in the mine office and in fire bosses' "shanties" underground, and these maps should also show the rock-dust zones and rock-dust barriers.

10. *Rock-dust barriers* should be used in order to confine to the zone or section where it originates any incipient explosion that might be started, either from failure to maintain sufficiently the rock-dusting in that zone, or from ignition of an accumulation of gas. Rock-dust barriers are not equivalent to generalized rock-dusting and are regarded by the Bureau of Mines as secondary defenses. It is easier to prevent by general rock-dusting the starting of a coal-dust explosion than it is to stop an explosion by barriers.

An explanation of what is meant by rock-dust barriers follows:

Rock-dust barriers are devices for limiting the propagation of an explosion of

coal-dust. They are shelves, movable or fixed, or closed containers generally extending across and being close to the roof of a passageway, and loaded with sufficient rock-dust to extinguish the flame of a dust explosion and capable of quick discharge of contents. Testing has shown that to be successful they must discharge and scatter from 50 to 100 pounds of rock-dust per square feet of cross-section of the passageway into the air immediately before the arrival of the flame.

Barriers might be designed to discharge by an electric circuit established by the melting of a foil device placed at a distance inby and outby the barrier, but for simplicity barriers so far devised rely on the air pressure waves immediately preceding the flame of explosive combustion of the coal-dust for their operation. As is the case in distributed rock-dust, the particles of barrier rock-dust absorb the heat of burning coal-dust adjacent particles and, by interposition between particles of coal-dust, screen from the effect of radiant heat. Rock-dust barriers so far devised will not extinguish gas-air explosions.

Many types of "barriers" have failed in the Experimental Mine when tested, because:

(a) The rock-dust has not been discharged quickly enough before the arrival of flame.

(b) There is not sufficient rock-dust discharged into the air.

(c) The rock-dust has been discharged en masse, which is especially liable to occur if the rock-dust is so damp that it sticks together. Inert dust or rock-dust that absorbs moisture quickly should not be used. Where the location in the mine is moist, inclosed barriers are advisable.

Some types of barriers have been successful in tests in the Experimental Mine under various conditions. The reports of earlier testing have been given in detail in Bureau of Mines Bulletin 167. Work of development and testing of barriers is being continued at the Experimental Mine. It is not expected that barriers will be successful under all the varied conditions found in mine explosions and in any case explosions between barriers may and have caused loss of life, where the dependence has been solely on barriers; hence it is advisable to use them as secondary defenses in these positions:

(a) At the mouths of principal branch entries;

(b) At all openings to panels;

(c) At approximately quarter-mile intervals on main entries;

(d) At the ends and connections of passages which do not have tracks, but are needed for ventilation or travel, and therefore can not be sealed off by strong fireproof stoppings, as is recommended by the Bureau of Mines for all abandoned or unused places.

RELATIVE EXPLOSIBILITY OF COAL-DUSTS

Intensive investigations in the Experimental Mine of the Bureau of Mines

¹ U. S. Bureau of Mines Information Circular.
² Chief mining engineer, Bureau of Mines, Department of Commerce.

³ Rice, G. S., Paul, J. W., and Greenwald, H. P., Coal-dust explosion tests in the Experimental Mine, 1919 to 1924, inc. Bulletin 268, Bureau of Mines, 176 pp. (In press.)

⁴ Rice, G. S., and others, Coal-dust explosion tests in the Experimental Mine, first series, Bulletin 56, 1913, 115 pp.; second series, 1913-1918, inc., Bulletin 167, 1922, 639 pp.

⁵ Rice, G. S., Paul, J. W., and Sayers, R. R., tentative specifications for rock-dusting to prevent coal-mine explosions. May, 1924. Reports of Investigations, Serial No. 2606, Bureau of Mines, May, 1924.

⁶ Rice, G. S., Sayers, R. R., and Harrington, D., Rock-dusting in coal mines, Information Circular No. 6030, Bureau of Mines, March, 1927.

have determined these principal facts regarding the relative explosibility of coal-dust and mixed coal-mine dusts:

All coal-dusts, except anthracite dusts, if in a sufficiently dense cloud in air may be ignited by a flame or electric spark and may produce a violent explosion.

"Explosive" coal-dust is of a size that will pass through a 20-mesh sieve, so the maximum diameter of the particle is about 1/30th of an inch. The mine-dusts in semianthracite, semibituminous, bituminous, and subbituminous mines differ in explosibility according to five factors:

- (1) Percentage of non-combustible in the dust as found.
- (2) Percentage of external water mixed with the mine dust.
- (3) Percentage of fine coal-dust in the mixture. That passing through a 200-mesh sieve is used as a measure of fineness.
- (4) Percentage of volatile matter in the combustible content of the dust, more commonly known as the volatile ratio.
- (5) Percentage of inflammable gas in the mine air.

Considering these five factors separately:

(1) *Percentage of non-combustible.* A mine dust, to prevent its propagating an explosion (no fire damp being present) must contain from about 20 percent, in the case of a low-volatile or semi-anthracite dust, to 75 percent non-combustible in the case of a high-volatile very fine size of coal-dust. In samples of mine dust it is impossible to distinguish between the ash of the coal-dust and the inert dust mixed with it by natural agencies. External ashy material or rock-dust has greater effect in absorbing heat than the inherent ash of the coal but it is not practical to separate in sampling.

(2) *Percentage of external water.* Small percentages of external or free moisture—that is, not inherent in the coal as water of composition or held in pores, has the practical effect on explosibility of dust projected into the air of so much incombustible, but in larger proportion there is a physical effect of causing the dust to adhere together or to stick to the floor, ribs, and timbering so that the dust will not be capable of being raised by air waves into the air as a dust cloud and propagation of an explosion will not occur in that place.

If, however, fine inflammable dust is carried along by the advance air waves in sufficient amount, the explosion may be propagated through a wet zone. The percentage of free moisture in the mixed dust that will prevent it rising as a dust cloud at the inception of an explosion varies from 15 percent for coarse dust to 30 percent for the finest sized dust.

The method of wetting coal-dust to prevent propagation of an explosion has failed because of the rapid drying of the coal-dust. Humidifying the intake has also failed because high relative humidity or even saturation of the mine air does not prevent an explosion from propagating in coal dust.

Watering at the face, however, and the use of sprays on cutter bars of mining machines, also sprinkling the tops of loaded cars, lessens the distribution of dry coal-dust and hence less frequent rock-dusting is required.

(3) *Percentage of fine coal-dust.* The finer the size of coal-dust in air, the more explosive it is. The criterion of fineness used by the Bureau of Mines is the percentage of dust passing through a 200-mesh sieve. A coarse mine dust,

say, 10 percent passing through 200-mesh, may require, for an explosive dust like the Pittsburgh bed coal-dust, 50 percent incombustible to render it harmless; whereas, a fine size of such dust may require 75 percent incombustible.

Most untreated mine dusts from top, sides, and floor, it is found from sampling hundreds of mines, average in size 20 percent through 200-mesh. Rib and timber dust samples, however, are usually much finer and if there are considerable amounts containing over 5 or 6 ounces of pure coal-dust per linear foot of passageway, then an increase of incombustible may be needed to prevent propagation of an explosion up to the percentage required for the fine (pulverized) coal-dust of the specific kind.

It has been demonstrated by tests that a coal-dust explosion may be propagated by timber and rib dust containing a large proportion of pure coal-dust, even if the bottom or floor dust is not an explosive mixture and the reverse is also true that a floor dust rich in coal-dust may propagate an explosion, although the ribs and timber have been rock-dusted, unless the cross timbers are so laden with rock-dust as to act like rock-dust barriers. Hence the necessity of sampling separately dust from the timbers and ribs from dust on the floor of mine workings, to determine when there is need of cleaning and of re-rock-dusting.

(4) *Percentage of volatile combustible matter.* The percentage that the volatile combustible matter is of the total combustible (commonly spoken of as the volatile ratio) is a most important factor in comparing the explosibility of mine dusts of different composition. The Bureau of Mines uses as a measure of this factor the percent of incombustible in a dust (ash plus moisture) which will just prevent propagation of an explosion by a specific coal dust. The limiting percentage varies from 20 percent incombustible, to render a semianthracite non-explosive to 75 percent for high-volatile coal dust of the finest size. With coarser dust, such as most often found in mines, 20 percent through 200-mesh, the requirement, when no appreciable amount of fire damp is present, is about 65 percent (ash plus moisture) for an average high-volatile coal dust.

(5) *Percentage of inflammable gas.* The effect of methane in air below the lower explosive limit of the methane-air mixture, about 5.2 percent, is that, to prevent propagation, an increase of incombustible in the dust is required in direct proportion to the percentage of methane. The increase varies from 3 percent incombustible in case of the finest size of high-volatile coal-dust, to 10 percent for dusts of low-volatile coals, which without any methane present have a low order of explosibility.

CONCLUSION

From a study of the foregoing factors in the relative explosibility of different coal dusts, it is evident that while each of the different factors has a wide range of values and some combine to increase while others tend to decrease explosibility of a given mine dust, the only safe procedure in the preventing of disastrous explosions is to rock dust thoroughly in every accessible part of a mine. Re-rock-dust immediately when the content of either floor dust or rib and timber dust falls to 55 percent in any zone in the mine and maintain at all times the average non-combustible content of the mine dust above 65 percent.

PRODUCTION OF FELDSPAR IN 1926

THE crude feldspar sold or used by producers in the United States in 1926 amounted to about 209,600 long tons, valued at about \$1,607,000, or \$7.67 a ton, according to reports obtained directly from producers by the Bureau of Mines, in cooperation with the geological surveys of Maryland, New York, North Carolina, and Virginia. These figures show an increase of 13 percent in quantity and 22 percent in total value compared with 1925, and represent the largest production and value ever recorded. Feldspar was mined and sold in 1926 in 12 states, namely, Arizona, California, Colorado, Connecticut, Maine, Maryland, New Hampshire, New York, North Carolina, Pennsylvania, South Dakota, and Virginia. The greatest feldspar-producing region is that which includes the Atlantic Seaboard States, from Maine to North Carolina. This region reported about 93 percent of the total production and value in 1926.

Except for minor purposes, feldspar is prepared for use by grinding. This work is done principally by commercial mills; only a very small portion is ground by users in their own mills. In 1926 there were 29 commercial mills operated in 13 states, namely, California, Colorado, Connecticut, Illinois, Maine, Maryland, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, and Tennessee. These mills reported 225,362 short tons of ground feldspar sold in 1926, valued at \$3,775,797, or \$16.75 a ton, compared with 212,858 tons, valued at \$3,603,845, or \$16.93 a ton, in 1925, an increase of 6 percent in quantity and 5 percent in total value. Of the quantity sold in 1926, 199,215 short tons, valued at \$3,246,174, or \$16.29 a ton, was domestic feldspar, and 26,147 tons, valued at \$529,623, or \$20.26 a ton, was Canadian feldspar. Canadian feldspar was ground in three states in 1926—New Jersey, New York, and Ohio. These figures represent increases in production and value of domestic feldspar and decreases in Canadian feldspar as compared with 1925.

CRUDE FELDSPAR SOLD OR USED BY PRODUCERS IN THE UNITED STATES IN 1926.

State	1926 (a)	
	Long tons	Value (b)
Arizona	(c)	(c)
California	6,200	\$49,300
Colorado	(c)	(c)
Connecticut	11,400	87,860
Maine	33,800	306,600
Maryland	(c)	(c)
New Hampshire	33,200	287,500
New York	15,500	157,800
North Carolina	91,400	602,000
Pennsylvania	(c)	(c)
South Dakota	(c)	(c)
Virginia	(c)	(c)
Undistributed	18,100	116,000
	209,600	1,607,000

(a) Figures for 1926 are preliminary and subject to revision.

(b) Value at mine or nearest shipping point.

(c) Included under "Undistributed."

ROCK-DUSTING MUST BE THOROUGH

THE practice of rock-dusting bituminous coal mines, as a means of preventing and limiting disastrous coal-dust explosions, has undoubtedly saved the lives of hundreds of American coal miners within the past two years, although the practice is not generally compulsory and is, therefore, by no means universally followed in the United States, Director Scott Turner, of the United States Bureau of Mines, points out. The partial rock-dusting of mines, or rock-dusting by improper or inadequate methods, however, provides no assurance of safety, and rock-dusting may be worse than useless if it is not done adequately and systematically, Mr. Turner declares. Merely perfunctory scattering of rock-dust or sporadic rock-dusting at long intervals, or the rock-dusting of only a few main haulage ways, may result in an unwarranted sense of security. To provide adequate assurance against deadly mine explosions, all accessible open areas should be thoroughly rock-dusted, including haulage entries, air courses, rooms, cross cuts and pillar regions; and the rock-dusting should be replenished from time to time so as to hold the incombustible content of the rib, roof and floor dusts at all times over 65 percent.

The unfortunate occurrence of several disastrous explosions in bituminous coal mines in this country within the past few months makes it an opportune time to review just what the practice of rock-dusting has accomplished toward preventing such explosions, Mr. Turner continued. It is now approximately two years since the rock-dusting method has been tried more or less extensively in a considerable number of coal mines of the United States.

For the past ten years rock-dusting has been required in the gassy and dusty coal mines in France, and no explosion disasters have occurred in the French mines during this period.

In Great Britain rock-dusting has been required by law since January 1, 1921, in all but naturally wet mines, and since 1924 it has been required in all coal mines except the anthracite mines. Although many localized minor explosions of gas have occurred in face workings, no major explosions have occurred in rock-dusted mines in Great Britain since January 1, 1921, except in the case of a recent explosion in South Wales, in which a strong gas explosion destroyed the ventilating currents. The government inspector reported that, had it not been for rock-dusting, the disaster would have been more terrible.

In the bituminous mines of the United States from January 1, 1926, to May 1, 1927, there were 16 major explosion disasters, in each of which more than

five men were killed. Two other incipient explosions in rock-dusted mines killed four men and one man, respectively. In all these explosions, 438 men were killed. Eight of the mines were rock-dusted, at least in the vicinity of the origin of the explosions of gas or coal-dust; and this rock-dust, by extinguishing the flames, localized, or aided in localizing, the explosions. Fifty-seven were killed by these incipient explosions, but 1,892 other men who were exposed to the liability of death, escaped. According to the testimony of state mine inspectors, of mine operators, and of Bureau of Mines investigators, it is probable that a large proportion of these men would have been killed had it not been for rock-dusting.

Two other explosions, occurring in partly or imperfectly rock-dusted mines, killed 131 men out of 173 who were in the mines. If rock-dusting is not efficiently done and maintained up to an approved standard, in parallel air passages as well as haulageways, it is not effective.

During this same period, January 1, 1926, to May 1, 1927, eight explosions occurred in non-rock-dusted mines, killing 244 men out of 761 in the mines.

It seems clear that, from an explosion-risk standpoint, partly or imperfectly rock-dusted mines class with non-rock-dusted mines. On this basis, there have been, since January 1, 1926, ten major explosions in partly rock-dusted and non-rock-dusted mines in contrast with seven explosions of a limited character in rock-dusted mines. In the former, 555 men out of 934, or 60 percent of the men in the mines, escaped, whereas in the rock-dusted mines, 2,078 out of 2,135, or 97 percent of the men in the mines at the time of the explosion, escaped death.

These figures clearly show the merit of rock-dusting. The method will not prevent local gas explosions, but if properly done and maintained, according to Bureau of Mines standards, there can be no doubt of its success in preventing great wide-sweeping coal-dust explosions that destroy numerous lives and a vast amount of property. The cost of rock-dusting is comparable with accident insurance premiums, apart from the humanitarian and psychologic value in saving life and improving morale.

All entries, rooms, and pillar or other open, accessible workings, should be rock-dusted at all points. The mine dust should be systematically sampled, the non-combustible content determined, and the results recorded by sections or zones. Redusting in any zone should be done when the non-combustible content falls to 55 percent, to the end that the average content of the mine dust is held in excess of 65 percent non-combustible.

PRECIPITATION OF GOLD AND SILVER FROM CYANIDE SOLUTION ON CHARCOAL

A STUDY designed to develop improvement in the cyanidation of gold and silver ores by means of precipitation of these precious metals from cyanide solution on charcoal has been made by the Rare and Precious Metals Experiment Station of the United States Bureau of Mines located at Reno, Nev. The study was intended primarily to investigate the possibilities in practice and, secondarily, to investigate the mechanism of the precipitation itself.

Charcoal is a strange and interesting substance, state John Gross and J. Walter Scott, in a report just issued. The fact that charcoal has the power to abstract gold and silver from cyanide solutions to the extent of 7 percent of its weight in gold and 3 percent of its weight in silver without showing the slightest change in appearance, even under the microscope, clothes it with a mystery that has long interested metallurgists. Even now, with the mass of data made available by various investigators, much remains to be learned. At present charcoal absorption is being studied by many persons, and their investigations may eventually lead to its application to purposes not yet dreamed of.

During the investigation made by the Bureau of Mines many ramifications were revealed, in following any one of which a lifetime could be spent. Charcoal, the chief factor, is subject to myriad variations due to differences in raw materials, preliminary treatment, and methods of charring. Added to the variations possible in the charcoal itself are those possible in solutions and in methods of precipitation.

The results obtained in this investigation are summarized as follows:

The mechanism of the precipitation involves absorption accompanied by a chemical change.

Precipitation of silver on charcoal from cyanide solution follows the same laws as precipitation of gold, although it is slower; charcoal has less capacity for silver than for gold.

The limit of charcoal precipitation from cyanide seems to be about 2,000 ounces of gold and about 1,000 ounces of silver per ton of charcoal.

Little difference exists among charcoals prepared from different woods.

The most important point in the making of charcoal is the heat treatment, either during the making or subsequent thereto.

To quench charcoal does not improve it. Pulverization finer than 200 mesh does not appreciably add to the efficiency of charcoal.

Few substances in the solution appreciably affect precipitation.

The adsorbed gold or silver salt is soluble to some degree in boiling water, and is especially soluble in hot cyanide.

There is a possibility of so changing the adsorbed gold or silver salt on charcoal that the charcoal may be used for further precipitation.

Further details of this investigation are given in Bureau of Mines Technical Paper 378, "Precipitation of Gold and Silver from Cyanide Solution on Charcoal," copies of which may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at a price of 15 cents.

AREA OF UNSUPPORTED ROOF IN COAL MINES—CONDITIONS AND FACTORS FOR CONSIDERATION¹

Ratio Between Supported And Unsupported Areas—Ratio Between Single and Multiple Posts—Effect of Various Widths Of Workings—Conditions Governing Their Determination—Roof Hazards Reduced By Narrow Work

By J. W. PAUL*

WHEN coal is removed in the process of mining, the native support of the roof material exposed has been taken away, and the character of the roof material and the size of the excavation are the principal factors that determine whether the roof will stand alone or will need artificial support in the form of timbers. Where the stresses in the roof are not unduly thrown out of equilibrium and where the immediate roof has a texture which admits of its forming a bridge in the nature of a beam or slab, supported at two points, there may be no necessity for artificial support, but this can be determined only by trial, and during the period of trial it will be advisable always to set caution or temporary timbers.

Under certain physical conditions of roof material, and under certain methods of mining, it will be found that for the support of the roof there will be a well-defined ratio between the area supported and the area that will remain in place without timber support.

In considering this question it may be pertinent to inquire what area of roof is supported by a single prop, a prop with a certain size of cap, or two props and a cross bar.

Where props are found to support the roof when placed 4 feet apart in rows 4 feet apart, each prop will support 16 sq. ft. Where it is necessary to reduce the spacing to 3 feet in either direction, the area supported by a single prop will be 9 sq. ft. An area which can be supported by props set 3 feet apart may be supported by props 4 feet apart if caps are used on the props.

In considering the area to be supported some arbitrary condition must be assumed. In entries it is customary to assume the width as the controlling factor. If the roof in an entry 10 feet wide will be self-supporting, but in an entry 15 feet wide will not be self-supporting and will require timbering, then the width of entry that should be adopted becomes a question of both safety and economics. The narrower entry will need no timber, but the wider entry will facilitate ventilation and transportation if a system of timbering is adopted that will hold the roof in place and if material from falls is not stored along the rib of the entry.

Width of excavation appears to be a decidedly important factor for consideration in determining the need for roof support. The roof material that is held in place with timber may be compared with a series of lintels or beams rigidly supported at each end and uniformly loaded. Just where the uniformity of loading begins will depend upon the elasticity of the material, since, if the material is tough and hard, a part of the beam will be supported by cantilever action. The cantilever effect is often destroyed by the placing of shot holes so close to the roof that the roof material is

shattered at the rib of the coal. This often results in fracture of the roof along the rib and the miner will say that the roof is "cutting" along the rib; the roof "cutting" may also be due to other causes than improperly placed shot holes.

At the face the roof slab will be supported at each end and along one side by solid coal, and under these conditions a greater area will be self-supporting than in the zone further back from the face.

This face slab of roof material constitutes a critical hazard; the greater percentage of accidents from falls occur between the face and the last line of props or roof supports, as it is at this location that most of the miner's work is done. The largest area of unsupported roof is at the face immediately after the coal is blasted down. The roof immediately over the mass of loose coal that has been blasted down usually can not be supported until after some of the coal has been removed, but it is always possible and highly desirable to set timbers under any part of the roof under which the miner or loader may have to work preparatory to loading out the coal.

In order to safeguard the man at the working face it would be of great value to determine as a minimum limit the area that should be left without temporary or permanent support by the use of timber. Any area in excess of this should be timbered in accordance with a definite schedule or system. No timbering system is complete that does not call for temporary or safety props where there is the slightest indication of unsound or unsafe roof as determined either by appearance, by the presence of slips, or by testing the material with a bar.

Some types of coal-cutting machines require that a space extending across the face and 12 feet from the face be free from props. Only exceptionally good roof will admit of safe operation where props or other timbers are kept as much as 12 feet from the face during the time occupied in cutting the coal. Under the most favorable roof conditions there is little justification for exposing the machine men and the miners to the liability of a fall of roof material where at least temporary props could be placed, even though the movement of the machine would require their resetting.

If accidents from falls at the face are to be materially reduced, greater attention must be given to the support of the roof at the working face. In coal over 5 feet thick, wooden cross bars may be hitched into the rib or at the face at one end and supported by a prop at the other end. In low coal small sections of steel H or I beams may be similarly placed. After the necessary props have been placed, the cross bars may be removed and used again as the place advances.

The maximum area of unsupported roof in room and pillar work may not be so important as in longwall work when based upon efficiency of operation, but is equally as important from a standpoint of safety. In longwall work the minimum area is determined by a cut and try method until it is found that there is a maximum area that will remain in place without support. This area, however, may differ for different roof conditions, and especially the speed and regularity of advancement of the working face. In longwall work the keeping open of the working face is of the greatest economic importance, whereas in room-and-pillar work a fall of the roof at the face may result in little reduction in tonnage; the miner will have to clean up the fall provided he was not caught under it, and the economic balance of the mine has been little disturbed.

Where bad roof conditions prevail systematic timbering is essential to keeping the mine in operation, and where timbering is very essential for the recovery of the coal an element of safety to the workmen is present which is often absent in mines with better roof and where the timber is set without any regularity or in accordance with any system.

The present trend in many mines is the introduction of narrow work—driving of all entries and rooms narrow, 10 to 12 or 14 feet—and this should bring about a reduction in roof hazards. In concentration of mining, where large numbers of men are assembled in groups, especially where long faces are employed and mechanical loading devices, there is need for close supervision. Where this close supervision is in effect there is less probability of the roof being neglected. Although, on the other hand, there is the added hazard from inability to hear incipient roof movement because of the noise from the machinery.

Local conditions will always necessitate special consideration with respect to any system of timbering, but in most mines there is great similarity of these local conditions from place to place in the mine, and once a system is adopted for one unusual condition or irregularity of the roof, the same system of roof support may be used to advantage wherever unusual conditions are encountered. The adoption of plans for roof support in some mines make it necessary to have alternative schemes—one for normal roof conditions, another for abnormal roof, and a third for extra hazardous roof which calls for special treatment in determining the system best suitable.

A detailed study of the area of unsupported roof at the working face should result in the adoption of a system of roof support that will give the miner, the machine man, and the loader a longer lease on life; and this is an outstanding problem that is within the province of solution by the officials and engineers in charge of each individual mine if they bend their energies to the task.

¹ U. S. Bureau of Mines Information Circular.
* Senior mining engineer, Bureau of Mines, Department of Commerce.



Shaft Sinking at Mother Lode Mines

Sinking of the shafts at both the Argonaut and Kennedy mines at Jackson, Calif., has been resumed. The Argonaut shaft, an incline, has passed the 5,400-ft point. The Kennedy shaft is vertical and is being extended to a vertical depth of 4,764 ft. The two shafts have reached approximately the same depth vertically. The Argonaut and Kennedy mines are the deepest gold mines in the United States. Ore bodies of good grade have been found on the deepest levels. As soon as sinking is completed, the opening of new levels will begin.

Sinking at North Star Mines Completed

The intensive development campaign at the North Star mines, Grass Valley, Calif., begun about three years ago, is now practically completed. The vertical shaft was deepened to about 4,000 ft. and two inclined winzes sunk to connect with the vertical shaft.

Hoisting of ore through the vertical shaft will soon begin. This will effect a reduction in costs, as there will be much less rehandling of the ore underground.

Steel Merger on Pacific Coast Forecast

Merger of the Columbia Steel Corporation and the Pacific Coast Steel Company, involving plants and holdings in California, Portland, Seattle and Provo, Utah, was forecast recently.

The Columbia Steel Company distributes 85 percent of the pig iron used on the Pacific coast. Its coal and iron deposits are near Provo, Utah, and its foundries and mills are located at Portland, Oreg., and Torrance and Pittsburg, Calif.

Pacific Coast Steel, with its subsidiary, Southern California Iron and Steel, operates open-hearth steel manufacturing plants at San Francisco, Portland, and Seattle.

Progress at the Carlisle Mine

The old Carlisle mine in the Steeple Rock district of New Mexico, 13 miles east of Duncan, Ariz., is being reopened by the United Metals Corporation.

The main shaft is being unwatered and reconditioned for additional development. This shaft is down to the 500 level with a winze sunk 125 ft. below that level. Development plans contemplate sinking the winze another 200 or 300 ft.

to further develop the ore body which was opened on the bottom level. If the size of the ore bodies warrant it, a new operating shaft will be sunk.

The Carlisle mine is credited with a production of \$6,000,000 in gold from the upper levels. At greater depth the ore changed to complex lead, zinc, silver, gold ores which could not then be successfully treated.

Shaft Sinking Progress at North Lily

Excellent progress is being made in sinking the shaft at the North Lily mine, Eureka, Utah. The shaft has four compartments, of which two will be used for hoisting, one for ventilation, and one for manway.

A second ore discovery is reported on the 700-ft. level at approximately 250 ft. northwest of the original discovery. The drift on the 900 level is making good progress and will soon reach the area in which the downward continuation of the ore body may be expected.

Manganese Company Organized in Washington

The Washington Manganese Mining Company has been organized to develop the Crescent Manganese mine, near Fairholme, on Lake Crescent, Wash., and jack hammer drills are operating in the face of the 190-ft. tunnel. A tramway, leading from the mouth of the tunnel to the ore bin, has been started and a large ore bin will be built at the railway siding.

Black Range Mill Being Remodeled

The mill on the Black Range Mining Company's property near Santa Rita, N. Mex., is being remodeled, with Phillip N. Merry, formerly chief engineer of the Combined Metals Reduction Company at Bauer, Utah, in charge. Selective flotation is to be used at the mill.

C. & A. Plans Development

Preparations have been completed for an intensive campaign of development at the Hiltano group of silver-lead mining claims, according to H. A. Clark, general manager of the Calumet and Arizona Mining Company, Warren, Ariz. This firm recently acquired the claims, which are located a few miles east of Tucson. New material and equipment for the work have arrived at the prop-

erty, preliminary water development is nearly completed and the gopher shaft has been sunk to a depth of 178 ft. Miners are employed at three of the various shafts on the claims.

Domestic Manganese & Dev. Co.

The Domestic Manganese & Development Company, a new corporation, has leased the plant of the old Butte Reduction Works at Butte, Mont., from the Anaconda Copper Mining Company, John H. Cole, of the latter company has announced. The plant has been idle for 18 years. It will be put into commission as soon as possible, probably early in September, to treat manganese ore of the Emma Mine of the Butte Copper & Zinc Company and other properties which the company has under lease in the vicinity of Butte, Philipsburg and Grace, Idaho.

The Domestic Manganese & Development Company is a closed corporation, capitalized for \$250,000. The board of directors includes Mr. Cole, president; H. A. Papally, vice president; Richard G. Jones, treasurer; Cathryn L. Cole, secretary; and Frank T. Boyd.

Tintic Standard Controls Iron King Cons.

The Tintic Standard Mining Co., through the purchase of an additional 600,000 shares of stock of the Iron King Consolidated Mining Co., held by Col. C. E. Loose, of Provo, has acquired control of the latter property, according to James W. Wade, who is now managing operations for both companies.

Stockholders of the Iron King recently elected E. J. Raddatz president and general manager and James W. Wade, assistant general manager of the Tintic Standard Mining Company, to the Iron King Consolidated board of directors; agreed to allow the Tintic Standard Mining Co. to direct the operation policy at the Iron King for a period of five years; and appointed Mr. Wade as general manager.

Bisbee Queen Shaft Completed

The new three-compartment shaft put down by the United Verde Extension Mining Company on the Bisbee Queen property in Gold Gulch, near Warren, Ariz., has been completed. Stations have been cut on the 200, 600 and 800 ft. levels and extensive exploratory work on these levels will soon be in progress.

Long Tunnels for Tailings at Miami Copper Company

In preparation for the disposal of tailings at a new tailings dump site near Midland City the Miami Copper Company will drive several tunnels through the hills east of Miami. These tunnels will aggregate 4,000 ft. They will carry pipe lines which will transport the tailings over a 3-mile course from the Miami mill to the new tailings dump site.

The contract for the tunnels has been let to Jack Hill and work has begun.

Phelps Dodge Lead Unit in Operation

The new 150-ton lead smelter of the Phelps Dodge Corporation at Douglas, Ariz., built to satisfy the growing need for lead-smelting facilities for ores from Arizona, New Mexico, and northwestern Mexico, is now in operation. The lead concentrator at Bisbee is also in operation.

Both mill and smelter will receive custom ores and a market is, therefore, afforded for both concentrating and direct smelting ores.

Railroads have recently published more favorable freight rates on lead ores and concentrates to Douglas.

Inspiration Consolidated Curtails Production

Because of the unsatisfactory condition of the copper metal market, there has been further curtailment at the Inspiration Consolidated Copper Company. An official statement issued July 7 follows:

"In view of the unsatisfactory condition existing in the copper market, the Inspiration Consolidated Copper Company has found it necessary to further curtail operations. The directors and officials of the company deeply regret the necessity of this step, but it is forced upon the company by circumstances beyond its control. It is estimated that some 400 men, mostly in the mining and concentrating departments, will have to be laid off at this time. This will reduce our force to about 2,000 men."

Thompson Smelter Active

It is reported that the Thompson smelter of the Mason Valley Mines Company, Wabuska, Nev., George A. Kervin, general manager, is treating a daily tonnage of 1,200 tons of ore, with 165 men employed at the mill and mines. A new crusher unit was recently added to the mill. Regular shipments of heavy sulphides are made from the company's mine at Balaklala, Calif. In addition four cars per week are received from the Consolidated Virginia and Dayton Syndicate.

Mining Group Will Fight Proposed Tariff Changes

Colorado mining interests are mustering their forces to oppose any program involving changes in the tariff laws which may come up before the next session of Congress, M. B. Tomblin, secretary of the Colorado Chapter of the American Mining Congress, has announced.

Preliminary steps in organizing resistance to any changes in the tariff will be taken by the executive committees of all state mining organizations which will meet in Denver late in July, he said.

During that meeting, operators will outline a program to be followed during the coming meeting in Salt Lake City of the Western Division of the American Mining Congress.

The hearing of the case of the Carson Investment Company against the Phelps Dodge Corporation and the Calumet and Arizona Mining Company at Tucson, Ariz., has been postponed until September 13 by Judge William H. Sawtelle, Tucson. This proceeding involves patent rights to the side-wall method of feeding reberberatory smelters, which George C. Carson claims to have originated.

Arizona Mine Assessments

Producing mines of Arizona have been assessed at \$275,242,627, an increase of \$11,260,298 over that for last year. Assessments are made directly by the state tax commission, and are based on the value of the stock of the company, earnings over a period of years, ore reserves, and a personal examination of the properties. The Morenci Branch, Phelps Dodge Corporation, topped the mines in increased valuation, showing a gain of nearly \$5,000,000. Magma Copper showed about \$2,000,000 and New Cornelia \$1,000,000.

Anaconda Subsidiary Buys Detroit Copper

The Anaconda Copper Mining Company, through a subsidiary, has acquired the assets and business of the Detroit Copper & Brass Rolling Mills. The plant will hereafter be operated by the American Brass Company as its Detroit branch and will be operated along the lines followed in the past by the Detroit company.

The Detroit plant has a capacity of 100,000,000 pounds annually of finished products and has been operating at 75,000,000 pounds. The plant is situated in the heart of the automobile industry and it is expected that the capacity of the plant will be increased.

North Butte Receivership Ended

Federal Judge Bourquin, acting on his own motion that no occasion existed for the receivership of North Butte Mining Co., has discharged the receivers and ordered them to make an accounting, and has restored the property to the management in charge before the receivership.

Receivership was granted on a secured claim of \$6,500. Judge Bourquin criticized the action of the receivers in filing their primary suit in Minnesota when all the company's properties are in Montana. The court stated that when all the costs, expenses, and compensation for the receivership are in the total will be many times the amount of the original claim. In a report of Butte Stockholders' Protective Committee assets of the company are given at over \$8,000,000 and the liabilities at \$855,000.

Minnie Moore Closed

The Minnie Moore mine at Bellevue, Idaho, has been closed after approximately \$1,000,000 had been expended by various interests in more than a half dozen campaigns, since the sinking of the Allen shaft in 1906, of which more than \$600,000 has been used in the current four years' campaigns, beginning with the Federal Mining and Smelting Company in 1923 and ending a few weeks ago.

The Minnie Moore is noted as having the largest silver-lead ore body of high-grade ore disclosed in history. This ore, it is stated, carried 70 percent lead and 120 ounces silver to the ton. The production of the mine down to the "great fault" on the 900 level is recorded at a total of \$10,500,000 smelter returns, or about \$1,000,000 from each level.

Ford Company Acquires Title to Idaho Properties

By a recent decision in Idaho, the Ford Motor Company is given title to a large mining estate in the Bayhorse district, Custer County, which includes the Red Bird and the Silver Rule mines. The company has had a contract for these properties since 1925 and has done considerable exploration work on them by diamond drilling.

The Ford Company purchased last fall a smelter site, a water-power site, and a site for an air port at Clayton, Idaho.

It is said that the Consolidated Smelting and Metals Corporation, Denver, is preparing to erect a 150-ton selective flotation mill on its Stevens property at Silver Plume, Colo. When completed the mill will cost about \$140,000. A recent report made by one of the corporation's engineers shows that there are approximately \$2,500,000 worth of lead-silver ore in the Stevens mine, which averages \$120 per ton.

FLUORSPAR DUTY DEBATED BEFORE TARIFF COMMISSION

Opponents and defendants of an increase in the present duty on fluorspar appeared before the United States Tariff Commission July 22 and 23, to present their arguments and testimony in behalf of the fluorspar producers on the one hand and the consumers of fluorspar on the other. The present duty on this mineral is \$5 per ton, and the maximum increase allowable under the flexible provisions of the tariff law is 50 percent.

All of the fluorspar producers testified that costs for 1925 were representative of conditions in the industry and that it was not possible to reduce operating costs. They testified that imports of foreign fluorspar had so affected American production as to force the closing of many American mines.

An increased duty on fluorspar, said Mr. G. H. Jones, president of the Hillside Fluorspar Mines Co., would enable American producers to expand their market as consumers frequently desired a single car of fluorspar instead of a shipload.

James A. Green, of Cincinnati, of the Holly Fluorspar Company of Kentucky, favored elimination of the foreign product from the American market. "The market has been circumscribed by a flood of foreign fluorspar," said Mr. Green. "American producers can not get into the Pittsburgh or Buffalo market. The principal steel works of America are depending upon foreign fluorspar. There is enough fluorspar in this country to last forever, but it can not be produced in the face of foreign competition."

R. C. Allen, Cleveland, of the Rosiclare Lead & Fluorspar Mining Co., compared the estimates of fluorspar reserves given in the report of the Tariff Commission with those prepared by a committee appointed by the Mining and Metallurgical Society of America and the American Institute of Mining and Metallurgical Engineers. The Tariff Commission report gives the total reserves (crude ore) in the central field embracing Illinois and Kentucky as 5,400,000 short tons, and the finished spar recoverable from crude ore as 2,660,000 tons. The report of the fluorspar committee, of which Mr. Allen is chairman, gives the total reserves as 7,206,973 short tons, and the total milled or salable spar at 70 percent mill recovery, 5,044,881 tons. Mr. Allen pointed out that their estimate covers present sources of production and possible future producers, while the Commission's report includes only the 52 mines now productive.

C. A. Buck, vice president of the Bethlehem Steel Company in charge of raw materials, not only opposed the application for an increase of \$2.50 per ton in the duty on imported fluorspar, but requested either outright elimination of the duty or its reduction by \$1.71 per ton. Of 50,000 tons imported in 1926, the Bethlehem Steel Company took 40,000 tons.

Mr. Buck stated that the Commission had exaggerated the cost of production of fluorspar in the United States. He stated that investigations by his company showed that producers of fluorspar in this country have made a profit on the average selling prices in the last six years. He also questioned the cost comparisons of the Commission between fluorspar produced in this country and in England, stating that the English selling price in the United States is not evidence of average cost of production of the English product. He thought the Commission's estimate of cost of production in this country should be reduced by \$5.31 for the purpose of comparison with the cost of the imported product. If this was done, he said, it would show that the cost of domestic metallurgical gravel spar at Pittsburgh would be less than the English product. For the American product it would be \$20.61 and for the British product \$21. Adjusted on the basis of the higher quality of the domestic product, he said the cost of the English product at Pittsburgh would be \$22.31, which, he said, would justify a reduction of the duty on fluorspar by \$1.71 per ton.

"If there is to be an upward revision of the tariff on fluorspar, there should also be an upward revision on finished steel products," Mr. Buck declared. "There even is ground for arguing that there should be no duty on fluorspar when viewed from the standpoint of eastern producers and others located elsewhere."

Mr. Buck said that his company had concluded that the reserves were so uncertain as to make the purchase of fluorspar properties by it inadvisable. In stating that these reserves would not last as long as estimated because of the gradual increase in the production of steel running close to double the present figure in 25 years. A request of the German Embassy that German producers of fluorspar be allowed to file a brief, was granted.

The Commission allowed interested parties until October to file briefs.

General Chromium Corporation to Consolidate Patent Rights

A new corporation, to be known as the General Chromium Corporation, has been formed by leading companies in the electro-chemical industry for the consolidation of important patent rights in chromium plating. The companies which are identified with this consolidation are the following: General Chromium Corporation; Union Carbide & Carbon Corporation, through its subsidiaries, Electro Metallurgical Company and Union Carbide & Carbon Research Laboratories, Inc.; and the Vacuum Can Company. The process covered by the patents is called Duro-Chrome.

The General Chromium Corporation, with its factory and electro-chemical laboratories at Detroit, and the affiliated plant and laboratories at Chicago and Niagara Falls, will operate as a production plant and will also license and furnish an engineering service for the Duro-Chrome process.

Climax Molybdenum Company

The Climax Molybdenum Company, Climax, Colo., is shipping from 23,000 to 25,000 tons of ore a month, as compared with 5,000 tons a month two years ago, and it is estimated that there are 20,000,000 tons of ore in sight. The ores are concentrated on the property and are shipped in large cans to the company's plant in Pennsylvania, where they are treated.

Crosby Mine to Reopen

The Crosby iron mine at Nashwauk, Minn., on the Mesabi Range, will be opened late this summer as an open-pit mine. The mine is one of the oldest producers on the western end of the range and was formerly operated as an underground project. The work of stripping and mining will be carried on under the direction of the Meriden Iron Co., of which J. A. Mackillican is manager. The fee is owned by R. M. Bennett interests of Minneapolis. Shipments amounting to over 2,000,000 tons have been made from this property, but no ore has been shipped since 1920.

The properties of the Tejon Mining Company, Gleeson, Ariz., are being cleaned up and preparations made for more extensive operations. Men are now at work retimbering the shaft, repairing the road and various mine buildings. A lighting plant is being installed and machinery has been ordered for the assay office. The main shaft at the Tejon is 515 feet deep and has 2,000 feet of drifts leading off from it and in the old workings there are about 5,000 feet of drifts.

UNCOMMON MANGANESE DEPOSIT

THE presence of manganese minerals on the eastern and southern borders of the Olympic Mountains, Washington, was known as early as 1912, when they were recognized in some copper prospects, but their possible value as a source of manganese only became evident during the World War. Attempts were made to work the deposits but were unsuccessful because the only materials that could be found contained too much silica to permit their conversion into alloys of acceptable grade. These deposits, which are known to be large, may yet become an important resource if the silica can be eliminated.

Since the war, however, prospecting along the north slope of the mountains has led to the discovery of several deposits, one of which near Lake Crescent has yielded in three years about 17,000 tons of ore containing more than 52 percent of manganese and less than 9

percent of silica, probably the largest concentrated body of this grade that has yet been found in the United States. Further prospecting has shown that there are other deposits on the southwest side of the mountains. Bulletin 795-A, "Manganese-Bearing Deposits near Lake Crescent and Humptulips, Washington"—a report of a preliminary study of all these deposits by a geologist of the Geological Survey, Department of the Interior, shows that although the mineral composition varies from place to place, they all lie at nearly the same stratigraphic position in the rock section, and the hope is held out that more deposits of high-grade ore may be discovered in the same belt. Prospecting in the region is much hampered by the heavy forest and thick cover of underbrush and moss, but as the timber is cut the search will be less difficult. The principal deposit was discovered in an area swept by forest fires several years ago.

Sulphur-Bearing Iron Ores of Michigan

A preliminary report of the investigation of the department of metallurgy and ore dressing of the Michigan College of Mining and Technology at Houghton, Mich., will be available within a short time.

The report is in the nature of a progress report and covers several hundred experiments, which deal with the use of leaching solutions and the solubility of the various sulphur minerals commonly found in the iron ores of the Michigan iron districts.

The occurrence of the sulphur has been studied and the minerals, pyrite, gypsum and barite appear to be carriers in the majority of cases. Barite was rarely found, the other two, however, were very common, occurring together in practically all the ores investigated.

In the majority of cases the gypsum readily went into solution, thereby reducing the sulphur content, but the pyrite, of course, was not amenable to this treatment. Where barite occurred no methods have been suggested for the elimination. Pyrite floats readily and is volatilized at low temperatures.

Large quantity tests are now under way in the hope of finding a method which the low margin of cost will permit using on a commercial scale.

PERSONAL ITEMS

Walter Douglas, president of the Phelps Dodge Corporation and a director of the Southern Pacific Company, and P. G. Beckett, vice president and general manager of the Phelps Dodge Corporation, have completed a tour of inspection of the corporation's mining properties in Arizona, New Mexico, and Mexico.

F. L. Ransome has resigned from the University of Arizona and has accepted the professorship of economic geology at the California Institute of Technology. A part of his time will be available for consulting work in general and mining geology.

F. W. MacLennan, general manager of the Miami Copper Company, and Mrs. MacLennan are on a vacation trip in western Canada.

E. E. Whiteley, assistant general manager of the Calumet and Arizona Mining Company, is recovering rapidly from injuries received when his automobile overturned after blowing a tire on a rear wheel.

C. E. Visel has been made mine superintendent for the Great Mexican Smelting Company, Estacion San Jose, Coahuila, Mexico.

L. O. Howard, manager of the International Smelter at Miami, Ariz., and Mrs. Howard are on a vacation trip in Canada.

Robert A. Kenzie, consulting engineer, of San Francisco, is in Alaska on professional business.

Thomas Taylor, general superintendent of the United Verde Smelter at Clarkdale, Ariz., is in Los Angeles on a combined business and pleasure trip.

Prof. George P. Schubert, who has been with the department of civil and mining engineering at the Michigan College of Mining and Technology for the past 23 years, has been appointed head of the civil engineering department.

E. G. Deane, for eight years manager of the Superior and Boston Copper Company at Copper Hill, Gila County, Ariz., has announced his resignation.

M. M. Duncan, for 30 years general manager of the mining department of Cleveland-Cliffs Iron Co., and for several years a vice-president of the company, has resigned as general manager of mines, but will remain with the company as vice-president with his offices at Ishpeming, Mich.

S. R. Elliott, who held the position of general superintendent, succeeds Mr. Duncan as general manager of the mining department. Mr. Elliott came into the employ of Cleveland-Cliffs about 30 years ago. He started as an engineer and later had charge of the mining properties for the company. He was subsequently superintendent of the Maas, Negaunee and Athens mines and about 10 years ago was made general superintendent.

W. G. Swart, consulting engineer for the Cusi Mexicana Mining Co., has returned to Duluth, Minn., following an extended trip in Mexico and the west.

On July 1 E. H. Wells, president of the New Mexico School of Mines, assumed his duties as director of the New Mexico Bureau of Mines and Mineral Resources, which was established by the 1927 legislature. The geological staff of the bureau will consist of Prof. W. D. Johnston, Jr., Prof. George B. Somers, and President Wells. Professor Somers has served on the faculty of the New Mexico School of Mines for the past two years as assistant professor of geology and mineralogy. Professor Johnston is at present employed by the United States Geological Survey as assistant to W. B. Lang, who is conducting potash investigations for the survey in southeastern New Mexico and west Texas.

In consideration of the important contributions to the metallurgical and chemical industries made by J. V. N. Dorr, president of the Dorr Co., Rutgers University conferred upon him the degree of Doctor of Science at its commencement on June 11.

Calumet & Helca To Extend Operations

Calumet & Helca Consolidated Copper Company, Calumet, Mich., plans to extend its operations on the Osceola lode by reopening No. 16 shaft which has been undergoing repairs for several months. The shaft will go into commission shortly, upon completion of the new railroad connections. No. 17 may resume later in the year if men are available, leaving only No. 18 idle. A vigorous program of shaft sinking and drifting is in progress at the C. & H. properties. Two shafts in commission all last year and a third in operation the latter half of the year produced a total of over 9,000,000 pounds of refined copper.

Shenango Furnace Buys Whiteside Iron Mine

The Shenango Furnace Company, which has held the Whiteside iron mine, situated near Buhl, Minn., on the Mesabi Range, under lease since 1906, has purchased the property from the owners and now has it in fee. The mine embraces 40 acres.

The Whiteside is a shaft mine, and, owing to the low prices prevailing for iron ore, coupled with high taxes, it has been impossible to operate it profitably for some years. This mine entered the shipping list in 1911 and the last shipment was made in 1918. The mine has produced a total of 759,181 tons, and its estimated ore reserves are 3,000,000 tons. Whiteside ore carries a great deal of moisture. The ore assays, natural, about 50.85 percent metallic iron, 7.82 moisture, 7.49 silica, and 1.088 phosphorus. There is a drying plant at the mine.

Park Galena To Install Flotation Unit

The Park Galena Mining Company, Park City, Utah, is making preparations for the installation of a flotation unit in its mill at a cost of approximately \$27,000, which will increase the capacity of the old mill to about 100 tons daily. A 200-ton ore bin and ore-handling facilities have been established at the mine and a road is being built to the highway about half a mile distant. Remodeling will not interfere with shipments of direct smelting ore, which are now being made to the Salt Lake smelter.

Metal Scientists Plan Exposition in Detroit

More than 25,000 executives, shopmen and scientists of metal working and treating industries all over the world will assemble in Detroit the week of September 19 for the technical sessions of four associations and for the National Steel and Machine Tool Exposition.

During the week the exposition is running in Convention Hall, Detroit, the American Society for Steel Treating, the Institute of Metals, the Society of Automotive Engineers and the American Welding Society will be meeting twice daily, from Monday through Friday, in the Statler Hotel, Detroit, to hear papers read by some of the steel industry's foremost metallurgists, some of its best-known engineers and some of its most capable executives.

The American Society for Steel Treating will discuss the manufacture, use and treatment of iron and steel. The Institute of Metals will take up non-ferrous metals. The production meeting of the Society of Automotive Engineers will go into the latest methods of production in all departments of manufacture. The American Welding Society,

which joins its discussions and exhibits with the others for the first time this year, will take up the latest developments and uses of welding equipment and material.

Old Bullfrog Mine Revived

The first carload of ore from the old Original Bullfrog mine at Rhyolite, Nev., has been shipped from Rhyolite to the Mason Valley smelter. The shipment is in the way of a trial to determine metallurgical conditions and is expected to realize about \$60 a ton.

P. J. McLaughlin and Los Angeles associates bought the mine recently from John Shirley, of Tonopah, and sank a shaft on the west side of the mill in order to be in new territory from which the old workings could be approached without danger of cave-ins. The ore is of the same famous bromide stain that started the name of Bullfrog to the camp and caused the ore to be placed in the windows of Tiffany's in New York City as the latest in gem stones.

Electric Railway Service on Mesabi Range Discontinued

The competition of the automobile and the concrete pavement have reduced the operating revenue of the Mesabi Electric Railway to such an extent that service has now been discontinued. A portion of the track has already been taken up. All remaining track will be taken up and cars and equipment sold. Most of the right of way is on mining land and reverts to the owners.

The Mesabi Electric Railway began operating its 40-mile line, giving service from Hibbing to Gilbert and intermediate points, in 1913.

Fire of undetermined origin broke out at the fifty-third level in No. 2 shaft of the Quincy Mining Company in the Michigan copper district the morning of July 8 before the night shift had started for the surface. No men were working above the seventy-seventh level at the time and no fatalities or injuries occurred, the men coming out through No. 6 shaft.

No. 2 and No. 6 shafts were immediately sealed to smother the fire. There is no timber in No. 2 shaft for 150 feet above the fire area, the shaft being through a solid unfractured rock formation.

The Garfield plant of the American Smelting and Refining Company, Garfield, Utah, has been damaged to the extent of \$40,000 by a cloudburst which sent a wall of water through the plant, causing suspension of operations for several days. The concentrates from the mills of the Utah Copper Company are treated at this smelter.

Cost Data Suit Dismissed

Carrying out the mandate of the U. S. Supreme Court, the District of Columbia Court has dismissed the suit of the Federal Trade Commission to require the Claire Furnace Company and other iron and steel companies to submit cost data reports. The District of Columbia Court of Appeals has yet to act on a companion case, that of the Maynard Coal Company. Argument on this case will be heard October 3. The coal companies are anxious for a decision, as penalties for failure to furnish the data have been assessed, though not collected, to the extent of \$10,000,000, for failure to furnish the information. It is expected the court will rule against the commission and in favor of the coal companies in this case.

Canadian Mining Congress

Scott Turner, director of the United States Bureau of Mines, has been designated by Secretary Hoover to represent the Department of Commerce at the Second Triennial Empire Mining and Metallurgical Congress, to be held in various Canadian cities during the period from August 22 to September 28. This designation has been made in response to a request of the Canadian Government. In suggesting the naming of Mr. Turner, his wide acquaintance with members of the mining and metallurgical industries in Canada was cited by the Canadian Secretary of State for External Affairs.

The Congress will be attended by nearly 2,000 representatives of the mineral industries from all parts of the British Empire. An important feature of the gathering will be the consideration of proposals made in London for the organization through the Congress of a great clearing house of information on the mineral resources and industries of the empire. Such a move would parallel similar work relating to the American mineral industries which Secretary Hoover has been organizing in bureaus of the Department of Commerce. The execution of these two projects would provide the mineral industries with accurate economic data relating to the major part of the world's mineral resources, and, it is hoped, may ultimately lead to the extension of the plan to France, Germany, Italy, and possibly other important industrial nations.

Potash Regulations

The Interior Department has issued circular No. 1120 embodying regulations governing the issuance of potash mining leases and prospecting permits under the act of Congress of February 7, 1927.

NO UNION WAGE ADJUSTMENTS—COAL DEMAND LOW

With consumers' stocks of coal gradually being depleted and the non-union mines producing sufficient coal to satisfy present demands, the chances for any wage adjustments between the miners' union and the operators appear to be as far off as ever.

Operations in the Pittsburgh district are by no means relative to the size of the district, and most of the operators could produce much more coal, so far as labor conditions go, than is being produced, the real restrictive being the difficulty in sales. This applies equally as well in other parts of Pennsylvania where mines are working non-union and also in West Virginia. It is expected that with the better demand that is bound to come shortly, more mines will start operating on an open-shop basis—not only in Pennsylvania and West Virginia, but also in Ohio where several properties are reported to be cleaning up preparatory to resuming operations on a non-union basis.

Early in July the United Mine Workers of Ohio rejected the proposal of the Ohio Coal Operators' Association to return to work at the 1917 wage scale of \$5 per day. Refusal of the proposal was made by the policy board of the state organization comprised of state officials of the mine workers and the six sub-district presidents. The proposal of the operators had been made in the form of an ultimatum, which if not accepted by July 15, the operators warned they would open their mines on a non-union basis. The rejection of the proposal by union mine officials was such as to not close the door to further negotiations as they asked the operators to join them in a joint conference to further consider the matter.

The Ohio miners are seeking a renewal of the joint conference of the Central competitive field, in preference to a conference affecting only Ohio on the ground that they feel it would be impossible to agree upon a scale affecting only this state. Such state conferences in Indiana and Illinois failed, they pointed out in the reply to the proposal of the Ohio Coal Operators' Association.

Officials of the Lorain Coal and Dock Company of Columbus, Ohio, plan to abandon their Ohio mining properties and move equipment to West Virginia, unless the miners' union makes an immediate effort to draw up a workable and competitive contract.

The abandonment plan was announced through Charles Albasin, commissioner for the Ohio operators, for E. F. Johnson, chairman of the board, and R. L. Wildemuth, general manager.

The Lorain concern has five mines in Belmont County, employing 200 to 600 miners each, with 9,000 tons daily production. The company also has 16,000 acres of Pittsburgh seam of coal in Ohio.

ILLINOIS OPERATORS INSIST ON WAGE CUT

There is no wavering on the wage question in the ranks of the Coal Operators' Association of Illinois, Rice Miller, president, said. He declared the producers are 100 percent for a lower production cost and that the coal industry of the state can not function unless such reduction is granted by the United Mine Workers of America.

Mr. Miller said that the mine workers' organization, both state and national, now have no negotiating contact with any group of operators anywhere in the country.

"The progress being made by the Western Pennsylvania field toward entirely open-shop production," said Mr. Miller, "particularly the Pittsburgh and Terminal Coal Companies, is steady and their output has now reached such volume that their fight is considered won.

"Determination of Ohio to win the 1917 scale is notably supported by the mine owners of that state and it is generally believed they will make more rapid progress in reaching good output under open-shop status because of the success attained in Western Pennsylvania.

"There continues to be no word of any Illinois mining company that even figures on trying to make individual settlement. Never to such extent did adherence to the association policy 'to fight it out along this line if it takes all summer' or even longer, seem so imperative."

EMPLOYMENT AND OUTPUT FIGURES HIGH IN PITTSBURGH

Production of former union mines which are now being operated on open-shop basis has been showing almost steady increase since the strike began on April 1. The Pittsburgh Coal Company broke all records for non-union production when 18 mines in this district produced 148,203 tons, compared with 133,446 tons in the previous week. Average number of men at work also surpassed the previous record with the total of 6,285, compared with 5,900 in the previous week.

The Vesta Coal Company, subsidiary of Jones & Laughlin Steel Corporation, resumed production at its No. 5 mine at Vestaburg. No. 6 mine has been operating for several weeks and production has been expanded to 3,000 tons daily.

Southern Roads File Tariffs Reducing Lake Cargo Rates

Railroads serving the southern coal fields have filed tariffs with the Interstate Commerce Commission, effective August 28, granting a reduction of 20 cents per net ton in lake cargo coal rates. This reduction is the same amount per ton as the reduction from the Pittsburgh and near-by districts, ordered by the Interstate Commerce Commission on May 9, to become effective August 10.

The action of the southern roads apparently follows much deliberation as to the practicability of making this reduction, for early in July a reduction of 10 cents per ton was announced by one road, only to be withdrawn within a few days. Southern operators held a conference at White Sulphur Springs, W. Va., following the withdrawal of the 10-cent reduction, which was attended by representatives of the various southern roads.

The reduced rate proposed by the southern carriers is subject to suspension and investigation by the Interstate Commerce Commission only upon complaint of some interested party.

Railroads serving the Western Pennsylvania, Ohio and Fairmont, West Virginia, districts have notified the Interstate Commerce Commission of their intention by August 10 to comply with the decision ordering lake cargo rates reduced.

Illinois Merger Effectuated

Eight southern Illinois coal mines, including the Southern Gem mines in Franklin and Perry Counties, have been taken over by a new corporation, the Brewerton Coal Company, of Delaware, which will own all the capital stock of the Brewerton Coal Company of Illinois and all common stock of the Interstate Coal Company, another new corporation.

The officers and directors of the three companies will be identical. The directors are W. A. Brewerton, J. M. Dillavou, Roy O. West, F. A. Thulin, E. A. Weber, and Thomas McLaren, of Chicago; N. F. Thompson, of Rockford; W. B. Crawford, of West Frankfort; and F. W. Longan, of Lincoln.

Bethlehem Mines Sold

The entire holdings of the Bethlehem Coal Company in Harrison and Marion Counties, W. Va., have been sold to the Bethlehem Fairmont Coal Company, according to a deed filed in the office of the county clerk of Harrison County. More than 1,300 acres of coal lands in Lincoln district, Marion County, and Clay and Eagle district of Harrison County, are transferred to the Bethlehem

Fairmont Coal Company, in addition to the entire equipment and machinery of their mines.

The three mines are the Helen's Run mine in Marion County, together with 741.91 acres of coal; the Scott mines on Mud Lick Run and Shinn's Run in Clay district, made up of 430 acres of coal; and the Peoria mines at Bingamon Creek, Clay district, including about 55 acres. All of the coal is of the Pittsburgh and Sewickley veins.

Coal Cleaning Patent Suit Before West Virginia Court

Probably the first suit involving coal cleaning patents ever filed in this country is now before the United States Court for the Southern District of West Virginia. The American Coal Cleaning Corporation, of Welch, W. Va., is suing the Gulf Smokeless Coal Company and Roberts and Schaefer Company for alleged infringements of patent rights in connection with the dry cleaning plant of the Gulf Smokeless Coal Company at Covell, W. Va. The amount involved is \$250,000. The taking of evidence was completed at Bluefield, W. Va., June 17, before Judge George W. McClintic, and the case will be argued at Charleston November 1.

A degree issued subsequent to the filing of the suit, originally instituted against the Gulf Smokeless Coal Company, admitted the Roberts and Schaefer Company as a party to the proceedings, inasmuch as Col. Warren R. Roberts, president of the latter company, pointed out that his company was the real defendant and that in their contract they agreed to defend Gulf Smokeless against any suits that might be brought for alleged patent infringements on the dry cleaning plant which Roberts and Schaefer installed for them.

Following adjournment of the court on June 17, Judge McClintic inspected the coal separators of the plaintiffs in operation at McComas, Mercer County, W. Va. At some later date the court will see the separators of the defendants in operation at the plant now used by the Gulf Smokeless Coal Company, at Covell, W. Va.

U. S. Steel Finishes New Coke Plant

The Carnegie Steel Co., subsidiary of the United States Steel Corporation, has completed the addition to the Clairton by-product coke plant, the largest in the world. Koppers Co. has installed 348 additional Becker type ovens, which will consume 3,887,250 tons of coal annually. This is in addition to 366 ovens with a capacity of 2,743,048 tons of coal, which have been in operation for some time. Total capacity will be 6,630,298 tons a year.

The Clairton coke plant will operate in conjunction with the blast furnaces and mills. The new addition to the coking facilities, which has been under construction for over a year, represents a total outlay of \$25,000,000, including the coal handling and transportation facilities.

The improvement included a complete change in transportation from railroads to the corporation's own river fleet on the Monongahela River. Underground conveyor systems have been constructed to carry coal from five mines located some distance back from the river to docks near Palmer, Pa. This portion of the improvement cost \$6,000,000. A similar system has been in operation for some time carrying coal from Colonial mines Nos. 1, 2, 3, and 4 near Brownsville.

SURVEY OF COMMERCIAL COAL STOCKS AS OF JULY 1 UNDER WAY

THROUGH the Bureau of Mines and the Census Bureau, the Department of Commerce is now making another country-wide survey of commercial stocks of bituminous and anthracite coal, as of July 1. The figures are expected to be available about August 15. This is the first survey made since April 1, when work was suspended in the unionized bituminous coal fields, and is intended to show to what extent coal stocks have changed since that date.

Fire Destroys Consolidation Plant

Fire of undetermined origin recently destroyed all of the surface structures of the Consolidation Coal Company's No. 12 mine at Borden Shaft, Maryland, rendering the mine useless until the damage is repaired. The loss is estimated at \$150,000.

G. Marshall Gillette, general manager of the Pennsylvania-Maryland division of the Consolidation Coal Company, said the buildings and equipment would be replaced immediately. Before the ruins had ceased to smoulder a large force of workmen had been set to work clearing away the debris and making ready for the construction crew to begin their work.

Fire Destroys Barnard Coal Tipple

Within two days after the resumption of operations at the mines of the Barnard Coal Company, fire believed to be of incendiary origin destroyed the main portion of the tippie on the morning of July 7, the loss being estimated at \$40,000. The plant is operated on a nonunion basis and employs approximately 100 men. The company will rebuild the tippie immediately, officers have announced.

Sunday Creek Reorganizes

Reorganization of the Sunday Creek Coal Company, following the death recently of John S. Jones, chairman of the board of directors and president, resulted in the election of George K. Smith, closely associated with Mr. Jones for many years as chairman of the board. He also will continue as secretary of the company. Other officers selected are W. E. Tytus, president; Chester C. Cook, vice president and treasurer; O. S. Newton, vice president and general manager.

Colo. Fuel & Iron Changes

Changes in the executive personnel of the Colorado Fuel & Iron Company have been made in line with the company's program of expansion, it has been announced. The office of general manager has been abolished. E. H. Wetzel, who has been vice president and general manager, will continue as vice president, with broadened duties in that office. Part of the duties of general manager will be retained by Mr. Wetzel, while much of the detail work will be handled by W. A. Maxwell, Jr., production manager. In addition to being in charge of all real estate, timber and water properties of the company, Mr. Wetzel is executive head of the Colorado Supply Company and the Rocky Mountain Coal & Iron Company.

Standard Coal Co. Completes Tunnel

The Standard Coal Company has completed the construction of its tunnel, more than 9,000 feet in length, 6,000 feet through solid rock and 3,000 feet into coal, for service at its property in Standardville, Carbon County, Utah. It is to be the main portal to the mine and will take care of the entire output of coal from four separate veins of high-grade bituminous coal. Heretofore the coal has been raised vertically nearly 300 feet in height at the entrance, then dropped down again over the tramway to the screening plant. The tunnel will provide an absolutely level grade, it is stated.

Bessemer Coal & Coke Acquires Coal Lands

The Harmar Coal Company and the Indianola Coal Company have conveyed to the Bessemer Coal & Coke Company approximately 100 tracts of coal, ranging in area from a few acres to several hundred acres each, in Indiana, Harmar, West Deer and Hampton Townships in Pennsylvania. The Bessemer Coal & Coke Company has conveyed the coal to the Bessemer Coal & Coke Corporation. The tracts are along the right of way of the Bessemer & Lake Erie Railroad. The price paid has not been made public.

ELECTRIFICATION CUTTING MINING COSTS

SUBSTANTIAL progress is being made in electrifying the coal industry, it was stated before the meeting of the American Institute of Electrical Engineers at Detroit by the committee on applications of mining to machinery, of which W. H. Lesser, of Madeira, Hill & Co., is chairman. The major factor behind this change, it is said, is falling prices of mine products.

"The use of electricity," the report says, "is an important element in the solution of the problem of high mining costs. Adverse economic developments have forcibly brought to the attention of mine managers the necessity of replacing expensive labor by electrically operated mechanical devices."

Discussing electrification in the coal industry, the report says:

"Coal loading machinery operated by electricity has demonstrated its entire practicability and has shown a saving of 25 cents to 35 cents per ton in mining costs. Much study still remains to be made concerning the question of coordinating machine loading and mining methods. This new and concentrated use of power in a certain section of a mine means

a system, in order to obtain a good voltage regulation for not only the new equipment but the old as well.

"In gaseous coal mines where ventilating fans are electrically operated by power obtained from extensive high-tension system, it is necessary to provide an emergency source of power to operate the fan in case of the failure of the normal power supply. A successful installation of this type was placed in service during the past year, and it consists of a gasoline-engine-driven generator set which will supply power to the emergency motor connected to the double extending fan shaft. After a failure of the normal source of power, 30 seconds are required to automatically start the gas engine set and restore normal fan service."

"Many installations of electrical shovels have been made in the metal mining industry, and more recently, the coal mining industry is using this type of shovel. The Ward-Leonard control on the large shovel and a motor-generator set with direct current motors on the smaller shovels show the trend in the electrical apparatus used on shovels."

Pennsylvania Secretary of Mines Named

Walter H. Glasgow, of Scottdale, Pa., has been appointed Secretary of Mines of Pennsylvania by Governor Fisher. At the same time the governor announced the appointment of John R. James, of Scranton, and John I. Thomas, Johnstown, as deputy secretaries.

Mr. Glasgow succeeds Joseph J. Walsh, of Wilkes-Barre, who served as secretary under former Governor Pinchot. He assumed his duties July 1, and has begun the reorganization of the department.

Bethlehem Steel Reduces Accidents

The Bethlehem Steel Corporation has reduced the number of accidents almost 60 percent since the corporation first undertook safety and first aid education of its employees 11 years ago. The corporation's annual first aid and mine rescue meet was held at Bethlehem June 25. Approximately 1,800 employees receive a thorough training in first aid safety work every year.

Long-Wall Mining Begun in Anthracite Field

The mining of anthracite by the long-wall system was started July 7 by the C. M. Dodson Coal Company. The method has been advocated for 75 years by those who worked as miners in Wales and England in their youth and saw the plan operated there.

This is the first time in the hard-coal fields, in so far as is known, that the plan has ever been tried.

Word comes from Hazelton that a number of anthracite producing concerns and also selling companies have joined in a movement to aid the rehabilitation of the anthracite markets by having well-known chemists certify to the number of heat units contained in their coal. Not only that, but some of the operating concerns are guaranteeing not more than 10 percent of impurities in buckwheat; in stove and chestnut a maximum of 4 percent bone and an equal quantity of slate.

Brotherhood Mines in Receivers' Hands

The Coal River Collieries Company, with properties in Southern West Virginia and owned principally by the Brotherhood of Locomotive Engineers, went into the hands of the receivers July 14 by order of the United States District Court at Charleston, W. Va. The receivership was ordered as a result of a suite against the company by the Brotherhood Investment Company of Cleveland, which filed claims for \$1,775,000.

The Coal River Collieries Company came into the public eye five years ago when it refused to employ union miners and operated on an open-shop basis, although owned and directed by a union organization. The United Mine Workers carried their fight to the floor of the American Federation of Labor in a vain attempt to force the company to sign a contract with the miners' union.

Alta Coal Company Erecting Tipple and Washery

A new tipple and coal washery of 500 tons capacity is being erected by the Alta Coal Company at its Summit mine in Walker County, Alabama. The Black Creek seam of coal is being mined at this operation, and improvements in production and preparation facilities were necessitated to meet the growing demand for domestic and steam product. The property is owned by the Southern Cotton Oil Company.

New Cleaning Plant at Berwind-White

Mr. E. J. Newbaker, general manager of the Berwind-White Coal Mining Company, Windber, Pa., shortly before leaving for a six weeks' vacation trip to Europe announced for his company the acceptance of the dry cleaning plant designed and built by the Roberts and Schaefer Company of Chicago.

He stated that his company considers this new plant 100 percent efficient.

The plant is the largest built so far by the Roberts and Schaefer Company and handles 400 tons per hour of 3½ x 0" coal, screening this into various sizes required for treatment on the air tables, cleaning it and taking the sizes cleaned back to the tipple to be shipped separately, or combined as may be required.

The new revenue law passed by the Alabama Legislature in July imposes an additional half cent per ton severance tax on all coal produced in the state, or a total levy of 2½ cents. Iron ore, dolomite, and other minerals taken from the ground suffered an additional levy, or a new tax in cases where none already existed.

Philadelphia & Reading Making Ready to Increase Output

Although the working time of the collieries of the Philadelphia & Reading Coal & Iron Company has been unsatisfactory for the month of July, it has been announced that the cause of the slack time is the intention of the new directing heads of the corporation to get all the collieries in first-class shape so that virtually full time can be resumed the first week in August.

Engineers have been making a survey of the interior workings and bringing their maps up to date to show the amount of coal mined, the estimated minable coal and the amount of virgin coal and its location. There are rumors of a big expansion which will take place over a period of the next 18 months.

New Device Indicates Fire-Damp Presence

Fire-damp explosions in coal mines may soon cease to be a menace as a result of the recent development of an electrical measuring device said by engineers to be the most important safety invention for mines since the Davy safety lamp, says the Pennsylvania Public Service Information Committee.

The appliance consists of a small platinum coil, 1 in. long and five-thousands of an inch in diameter. It has been discovered that if such a coil is electrically heated to a constant temperature, its heat will increase in proportion to the amount of fire-damp, or methane gas, in the surrounding air.

The coil is inclosed in a gauze bonnet to prevent explosion, and is connected to an indicator calibrated to register the percentage of gas. If the air contains 5 percent or more methane, the indicator needle swings rapidly back and forth.

The electric coils can be placed at given points in a mine and made to record in the mine office. They can also be heated by dry cells and carried into the mine passages for air tests.

Mine Boss's Home Bombed

Two persons were rendered unconscious and four others had narrow escapes from injury when a dynamite bomb was exploded on the lawn in front of the home of John McMahon, mine foreman of the Clinton Block Coal Company, between Imperial and Clinton, Pa., the morning of July 8. The dwelling was badly damaged by the blast, which rocked the neighborhood.

Mr. and Mrs. McMahon were asleep on the first floor of the dwelling, a two-story frame house, when the explosion occurred. Both were rendered unconscious by the blast, but not seriously injured.

From evidence found on the lawn they believed that the dynamite was thrown at the house from a passing automobile after the fuse had been lighted.

The Clinton Block Coal Company operates a mine between Imperial and Clinton on an open shop basis.

PULVERIZED COAL TESTS

THE Shipping Board has designated the steamship Mercer for the further experimental work in connection with the burning of pulverized coal on shipboard. The shore tests, now completed, were carried on at the fuel testing laboratory at the Philadelphia Navy Yard, under the direction of Commander J. S. Evans. The Mercer is a 9,730-ton deadweight carrier now out of commission at Norfolk.

The results of the tests have created world-wide interest in shipping and marine engineering circles, because of the apparent practicability of burning low-priced coal under marine boilers, a feat which heretofore has been impossible. The coal is burned in virtually the same manner as fuel oil, with an almost similar burner.

Mine Workers Endeavoring to Reorganize Alabama

Plans for reorganizing the Alabama division of the United Mine Workers of America are being considered, following a mass meeting of 140 miners and mine workers held near Carbon Hill, Ala. At this meeting addresses were made by speakers who declared themselves in favor of allowing no Alabama coal to go to states where mine workers were striking, or where the union was not satisfied with the wage scale.

The United Mine Workers have been poorly organized in Alabama for the last several years. The 1920-21 strike had the effect of bringing about an open field there. Since then there has been no friction in the Alabama mining field, although the coal output has been heavy.

It is reported that the meeting, held early in July, has created very little interest in mining circles.

Koppers Company to Build in Pittsburgh

The Koppers Company, manufacturers of coal by-products, has purchased a site in the downtown business section of Pittsburgh, on which they have made application for a building permit to erect the highest building in the city. It is to be 30 stories high, in which it is proposed to house the various departments of the firm. The structure is to be 465 feet high.

Upper Matanuska Coal Field

The Secretary of the Interior announces the publication of a report prepared by the Geological Survey on the geology of the upper Matanuska Valley, Alaska, by Stephen R. Capps, with a section on the igneous rocks by J. B. Mertie, Jr. (Bulletin 791, U. S. Geological Survey.)

The region described in the report embraces a tract of about 200 square miles, including Chickaloon on the Alaska Railroad and the country east of it. Geologically the region presents many features of interest. Rocks of both sedimentary and igneous origin, which range in age from early Mesozoic or older to Tertiary, and glacial and other unconsolidated deposits, of Quaternary age, are widely represented.

Certain of these rocks contain beds of coal that are the main mineral resource of promise in the region. These coals range in quality from high rank bituminous to anthracite. The significant economic fact brought out by this report is that there are considerable bodies of coal in this upper Matanuska Valley which are of as good quality as any other coals of the entire Pacific coast.

The mining of these coals will involve many technical problems, as the beds are much folded and faulted and here and there are intruded by igneous rocks. Considerable prospecting should, therefore, precede any extensive expenditures. The mining would doubtless be costly, and at present there are no adequate means of transportation available. The competition which these coals would now face in the markets of the Pacific Coast from cheap California oil will inevitably decrease as the supply of oil for fuel becomes depleted. It is therefore safe to predict that at some future time, if not now, the coals in the upper Matanuska Valley can be profitably mined and will be a valuable aid in the development of Alaska's industries.

The report, in addition to giving all the pertinent geologic data, is accompanied by topographic and geologic maps and by numerous other illustrations, including cross sections and views of many significant geologic and geographic features.

The total production of bituminous coal during the current calendar year up to and including July 2 has amounted to 278,601,000 net tons, with a daily average production of 1,794,000 tons. During the same period last year 270,047,000 net tons were produced, with a daily average for the period of 1,739,000 net tons.

These figures show an increase in the production of bituminous coal during the current calendar year for the period mentioned of 8,554,000 net tons, or 3.1 percent.

C. F. & I. Forms Marketing Company

The Colorado Fuel & Iron Company has incorporated the Colorado Fuel & Iron Products Company, with a nominal capitalization of \$25,000, through which to distribute its products. Heretofore the company has not operated warehousing facilities in its trade territory, but has confined itself to making mill shipments. It is expected that one or more warehouses will be situated on the Pacific coast. Recently the company organized a market research department with C. H. Macdonald in charge to work in cooperation with the sales department.

Canada to Subsidize Coal Production

Canada has passed an act to encourage the production of domestic fuel from coal mines in Canada. The act is primarily to assist the coal-mining industry in the Maritime Provinces, but is general in its application. Under it the Minister of Mines may enter into an agreement for 15 years with any person approved by the Governor for the construction and operation of coal works. By "works" is meant by-product recovery coke oven plants or such other carbonizing plants for the production by heat-treatment from coal of a coke suitable for domestic use and gas, tar, and other by-products. The act authorizes an annual payment to individual contractors of 4 percent of the cost of constructing the works and 5 percent of the cost of the works if the contractor be a municipality or other public corporation. Payment in every case will be reduced by 5 percent for each unit of percentage by which the quantity of coal mined in Canada used in the works for the production of coke falls below 70 percent of the total quantity of coal so used. Companies which use only 50 percent of Canadian coal would receive no benefits from the act.

It is announced that the driving of a drainage tunnel into the mine of the Sandy Run Coal Company, near Free-land, Pa., has been completed. This will enable the company to reclaim a vast quantity of coal in a section of the operation which has been flooded for several years. The workmen driving the tunnel found large quantities of good virgin coal. Another important tunnel operation is that in the Drifton mine of the Lehigh Valley Coal Company, which is nearing completion. The company is having this work done to make a shorter route for coal from its nearby mines to the Drifton breaker, an addition to which is to be built once the tunnel is in operation.

The Midland Valley Railroad has asked the U. S. Supreme Court to review a decision of the Arkansas Supreme Court in favor of Thomas Barkley and others for failure of the railroad to furnish cars to Barkley's coal mines from August, 1922, to January, 1923. The case involves the question whether Congress by legislation with reference to the distribution of coal cars has set aside the common and state laws on the subject. The railroad declares that if the Arkansas court is sustained it will set aside car distribution regulation by the Interstate Commerce Commission.

PENNSYLVANIA CHAMBER OF COMMERCE TO STUDY COAL TAXATION

At a conference of directors of the Pennsylvania Chamber of Commerce at Reading, Pa., Alba B. Johnson, of Philadelphia, president, was authorized to name a committee to study the coal taxation question, both anthracite and bituminous, and suggest some method of equalization. It was stated at the conference that throughout the anthracite region each county and township has its individual method of assessments on coal-producing companies, the general idea being to impose as heavy levies as the traffic would bear. The same idea prevails in some of the bituminous sections, although not to the same extent as in the anthracite counties.

National Coal Meet Proceedings Published

The National Coal Association has just published the proceedings of its tenth annual meeting, held at the Edgewater Beach Hotel, Chicago, June 15, 16, and 17. The volume contains 270 pages, and includes the full accounts of all the sessions.

The Benoit Coal Company, Birmingham, is now producing coal from its Benoit No. 6 mine, in Walker County. A new coal storage bin is being constructed to care for the increased output and additional power equipment has been installed.

A cloud burst, followed by floods and heavy rains, did more than \$100,000 damage to coal mining and other property in Carbon County, Utah, early in July. Among the coal companies who suffered losses the Peerless and the Independent Coal and Coke, both with headquarters in Salt Lake City, appear to have lost the most. Some of the mines were closed temporarily.

Lehigh Valley Cars Set Record

Five hundred gondolas, carrying 70 tons, have been received by the Lehigh Valley Railroad. This sets a new mark in anthracite transportation history, the heaviest load a car could carry heretofore being 50 tons.

PERSONAL ITEMS

J. B. Warriner, of Lansford, general manager of the Lehigh Coal & Navigation Company, has been appointed by Governor John S. Fisher a member of the board of trustees of the Pennsylvania State College.

J. D. Zook, vice-president and general manager of the O'Gara Coal Co., has announced the appointment of Harold S. Kinney as general sales manager. Mr. Kinney for five years associated with the Ocean Steamship Co., five years with the Chicago and Western Indiana Railroad and Belt Railway of Chicago, and nine years with the Chicago, Wilmington and Franklin Coal Co. E. W. Broeckl, who has been with the O'Gara Coal Co. for several years, will continue as assistant sales manager. J. G. Bentley, formerly with Peabody Coal Co., has been appointed fuel and service engineer.

At a recent meeting of the directors of the J. K. Dering Coal Co. James B. Pauley, for the past two years president of this organization, resigned from the office of president to engage in new activities. Clarence B. Cardy, a member of the Chicago Bar Association, who for the past two years has been the vice-president of the company, was elected to fill the vacancy created by the resignation of Mr. Pauley. The latter will continue his connection with the company as a member of the board of directors. This change of officers became effective July 1.

United States Supreme in Oil Industry of the World

The supremacy of the United States in the petroleum industry is strikingly shown in a trade bulletin issued recently by the minerals section of the Department of Commerce. Seventy percent of the world's petroleum production, the bulletin reveals, is within our territorial limits. American refineries constitute the last word in mechanical equipment and efficiency in operation and their capacity far exceeds that of any other country.

Notwithstanding the fact that since the war many foreign countries have made strenuous endeavors to establish petroleum refining industries, few of them have attained any degree of success. The efforts of countries lacking domestic sources of crude petroleum, such as France, Germany and Australia, to build up what amounts to national refining industries have been to little purpose. For example, only one of France's 11 refineries is now operating and this one is unprofitable. Germany

has apparently abandoned the idea of establishing a petroleum-refining industry and has turned to the "oil from coal" process which is receiving intensive consideration from her scientists and engineers. Australia grants a large subsidy to its refining industry and has used every possible means to stimulate it, but it still continues to be a drain on the Commonwealth's finances.

Defends Policy of Oil Producers

"The petroleum industry is not entitled to be criticized or denounced because of the conditions which confront it today," according to Judson C. Welliver, director of public relations of the American Petroleum Institute.

"More than anything else it would like to be understood and to have its difficult problems realized by the public.

"The oil industry is one of several important ones that are at the moment suffering because of overproduction—their markets can not absorb all of their output. That is what causes the wheat growers' troubles, the cotton planters' woes, the bituminous coal operators' worries. The manufacturers of textiles and of boots and shoes are in like difficulties. Lumber producers are seeking to broaden their market, which does not call for all they are offering it.

"Fundamentally, the oil industry is in the same situation as these others—too heavy production has affected the price fabric, and in some cases profits have vanished or been turned into actual losses. But the oil industry, at least, has given the consuming public the benefit. The price statistics of the United States Bureau of Labor show that the price of gasoline in 1926 averaged only 18.1 percent above that of 1913, while the average of all commodity prices in 1926 was 51 percent above 1913.

"A study of the whole commodity price tabulation shows gasoline to be cheaper today, in comparison with other articles, and in terms of the general buying power of the dollar, than before the war. It stands at the bottom of the price list of commodities widely and extensively used. It is the cheapest great staple. It is so, because the industry has persistently given the consumer the benefit of better methods and constantly improving processes."

The proceedings of the Industrial Development Conference, held by the Southern Division of the American Mining Congress at Birmingham, March 21-22 last, have just been printed in a volume of 160 pages. Copies may be obtained from the American Mining Congress, Washington, D. C., at \$1 per copy.

BOOK REVIEWS

THE WORKING OF UNSTRATIFIED MINERAL DEPOSITS, by *George J. Young*, with a chapter on hematite ores by *T. S. Durham*, is a volume of 466 pages and over 200 illustrations. Published by McGraw-Hill Book Co., New York City. Price, \$7.

It is encyclopaedic in nature, and in addition to graphic descriptions of mining methods, processes and equipment, lays stress on the economic features of production and control of costs.

A gratifying novelty is a geographical index in addition to the regular index, whereby instant reference may be had to the mining operations of the entire world.

As a work of reference it should prove of value not only to the teacher and student, but to the operator who under abnormal conditions desires to evolve new and cheaper methods of extraction.

CONCRETE IN COAL MINE STRUCTURES, published by the Portland Cement Association, represents not merely a complete text book on concrete practice, but includes a bibliography, the whole being well indexed. *H. S. Wright*, structural engineer of the Portland Cement Assn., Chicago, is the author.

The advantages of the use of concrete in underground mining include its resistance to deterioration, its fireproof qualities, its impenetrability, and its strength against shock, which may be augmented by reinforcement, and the facility with which concrete construction may be adapted to size and shape of structure.

Its smooth dense surface eliminates pockets where gas may collect, and offers little lodgment for coal dust, while affording a minimum of resistance to ventilation, and furnishing a good light-reflecting surface.

The volume gives explicit instructions for mixing and laying under diverse conditions, with many illustrations and applications. Suggested forms of specifications for concrete shaft lining conclude the treatise. The whole represents the best thought and experience of the cement industry to date.

COAL IN EUROPE is the title of a pamphlet by *John R. Bradley*, Minerals Section, Bureau of Foreign and Domestic Commerce, just released by the Department of Commerce.

In a foreword Dr. Klein, director of the bureau, states that the outlook in the international coal trade is brighter than it has been for almost a decade, notwithstanding augmented production in Europe.

The recent labor troubles in the coal-mining industry in Great Britain permitted the re-entrance of American coals into many foreign markets. American investments in foreign industrial con-

cerns, increasing imports of raw products, and decreased coal production costs through the introduction of mechanical mining and increased non-union production of coal, all indicate increasing exports.

The situation in each of the coal-producing countries of Europe is analyzed and summarized, and lists of importers and consumers of American coals have been made available to American firms.

Costs and market prices, and production, with points of destination for European coals, freight rates, etc., are given for the respective countries, the whole forming a valuable reference work on the subject.

Navy and Interior Departments Make Oil Reserve Agreement

Secretary of the Navy Wilbur and Secretary of the Interior Work have reached an understanding relative to administration of naval petroleum reserves in California and Wyoming and leases of land in them, to be effective hereafter.

The understanding is based on interpretation of an executive order and congressional act and makes the Navy Department responsible for administration of all leases heretofore made in the reserves excepting three of producing wells in reserve No. 2, which were granted pursuant to authority specifically imposed on the Secretary of the Interior.

Approval of Congress for transfer of jurisdiction over these three to the Navy Department will be requested next session by the Interior Department, and by an agreement effective August 1, local control over the reserves is vested in inspectors under the Navy Department.

Local supervisors of the Geological Survey will continue to perform the same duties as heretofore, however, but will report to Navy Inspectors regarding the leases instead of to the survey director. The Navy Department will consult the Geological Survey on technical matters pertaining to the reserves.

The Navy Department also will determine the policy in regard to issuing any further leases on the reserves and announced that its policy will be one of conservation, an endeavor to keep as much oil in the ground for as long a time as possible.

With this in view, the department has closed in all of the 21 producing wells on land in reserve No. 1, the output of which heretofore has been at the rate of 1,500,000 barrels a year, and has made arrangements with neighboring operators whereby offsetting wells either have been shut down, or where the adjoining owner will pay the Government 55 percent of any increase in his production resulting from the shut-down of the Navy wells.

There is to be a meeting of American producers of manganese ores at the Willard Hotel, Washington, D. C., Tuesday, August 2, 1927. The purpose of this meeting is to organize and consolidate efforts in behalf of American manganese. Plans will be discussed and adopted on the following matters:

1. Methods to offset propaganda that has been circulated to the effect that there is no manganese ore in the United States.
2. A listing will be made of properties, developments and possible reserves of manganese ores, and methods will be discussed leading to an increase in productions from operations throughout the United States.
3. Methods to cooperate with the United States Tariff Commission in assembling data on manganese developments and reserves in the United States.
4. Methods to cooperate with the United States Geological Survey and Bureau of Mines in assembling data on manganese developments and reserves in the United States.
5. Present developments and methods to carry forward research in the beneficiation of the lower grade manganese ores.
6. Methods to oppose the present move for a reduction in the tariff on manganese ore.
7. Methods whereby the United States may be assured of an adequate supply of manganese in case of war or in time of an emergency.
8. Other questions of importance to the United States so far as manganese is concerned and questions of importance to manganese ore producers will be discussed.

All persons directly interested in American manganese ores are expected to attend, and it is hoped that each state may be represented by several individuals.

Manganese Committee:

*J. Carson Adkerson, Woodstock, Va.
N. H. Mannakee, Bluefield, W. Va.
H. A. Pumpelly, Oswego, N. Y.
J. H. Cole, Philipsburg, Mont.
Wm. D. Meyering, City Hall, Chicago, Ill.*

Applications have been filed with the Tariff Commission for both an increase and a decrease in the tariff on manganese ore. The commission has just recently announced that it has ordered under its general powers an extensive investigation of the manganese situation of the United States.

Propaganda against the tariff is being spread at large; representations are being made that there is no manganese in America and reports on file with many of the Government departments in Washington are to the effect that there is no manganese in the United States. The general impression prevails that there is none. The situation is absurd but none the less alarming.

A considerable amount of American capital has been invested in manganese developments in Russia and Africa. The increasing developments in manganese in this country is a source of alarm to the foreign shippers.

The United States consumes approximately 800,000 tons of manganese ore per year. The production from domestic mines in 1914 was 2,635 tons; in 1918 it rose to 305,869 tons; the production in 1922 was 13,404 tons. Due to

the tariff in the last few years widespread developments have gone forward. In 1925 the recorded shipments were 98,324 tons. Several large developments are now on the eve of production and foreign producers have awakened to the facts. Opponents to the tariff are putting out propaganda that there is no ore in the United States and at the same time are leading others to believe that the present mining is depleting the reserves. The total positive reserves of the United States is only 1,493,200 tons, according to the opposition. Opponents fail to show that mines of the United States have already shipped more than 1,493,200 tons of high grade manganese ore and that the deposits have hardly been scratched. They fail to show that various developments under the encouragement of the tariff have shown reserves 10 to 50 times greater than was admitted to exist and that new discoveries are being reported month by month. Manganese is somewhat in the same position that copper, lead and iron were many years ago. The existence and extent of the deposits of today were not known, now they are among the leaders of the world.

The manganese tariff increased the cost of a ton of finished steel product only 16 cents. This was apparently absorbed by the steel companies and was in no appreciable way reflected to the public in products sold. The tariff is refunded to the steel makers when the steel is used for export. It works no recognized hardship on any industry or class except the foreign producers of manganese ore. But the tariff follows a firm principle and is justified because it means a good source of revenue to the United States Government; it encourages the development of the manganese resources of America; it adds to our national wealth; it furnishes employment to thousands of men engaged in the development, mining, milling and transportation of the product, and most important of all it assures a dependable source of supply of this most essential material during a period of war or in a time of emergency. Americans must see that the manganese resources of America are developed before the foreign deposits are developed with American capital—particularly, so long as these developments increase rather than decrease our own known reserves of such an important war material.

The Tariff Commission is now investigating the manganese situation. They have been led to believe there is little, if any, ore in the United States. For this reason they may be inclined to remove rather than increase the tariff. The situation is acute and must not be underestimated.

Potash Explorations

The highest percentage of potash core recovery ever made in the United States in a core test was recently taken from the first Government test being made in Eddy County, N. Mex., according to W. B. Lang, geologist with the Geological Survey. The third test will be started at a point about 25 miles southeast of Carlsbad, N. Mex.

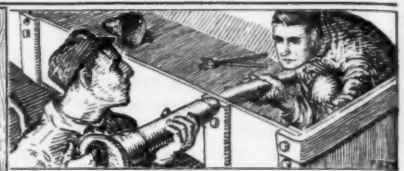
Oil Shale Discovery Decision

The Interior Department will not decide until probably early in September the pending case as to what constitutes an oil shale discovery under the mining law. Secretary of Interior Work, who heard arguments on this question last winter, was expected to have decided the case before he recently left Washington for a tour of inspection of various interests of the department in the West.

The Columbia Carbon Company has placed a new carbon black plant in operation in Hutchinson County, Tex., using 40,000,000 cubic feet of natural gas daily.



WITH THE MANUFACTURERS



Link-Belt Announces Anti-Friction Belt Conveyor Idler

Announcement is made by Link-Belt Company, Chicago, of the introduction of their Anti-Friction Belt Conveyor Idler and Return Rolls of an advanced type of belt conveyor equipment.

This equipment embodies many salient features of advantage in design which are the result of years of study and research.

Bearings are Timken tapered roller bearing type, which are totally encased within the roll hub.

The outstanding feature of the idler is the absolute protection afforded by a labyrinth grease seal, mounted in a grease cap which also serves as an out-board reservoir and lubricates the bearing on the outside as well as on the inside, especially when the roll is on an incline. This, in turn, is protected by a deflector plate which deflects dirt, dust, grit or any foreign material away from the bearings and grease seal, and will not permit the washing of the grease away from the labyrinth.

The rolls are mounted on a self-cleaning "T" base. All rolls are interchangeable, being capable of serving in any of the three positions. The entire frame is riveted, and is without bolt or nut to work loose or to come out of adjustment.

Another advantage is the close working tolerances to which all parts are built, closer than have ever been attempted in belt conveyor history.

The use of specially-constructed manufacturing tools assures alignment of bearings, and a well-balanced concentric running roll.

Special care is exercised in the machining of the roll shell, to obtain uniformity of thickness of the wall into which the machined heads are pressed and securely held in place by spinning.

The heads are dished for rigidity and strength, and the entire construction is such as results in maximum strength.

It is claimed also that the superior design and construction of the roll make it practicable to vary the characteristics of the material used for the roll shell. Further, a special iron has been developed for use in coke plants that resists the corrosive action of sulphuric fumes and the abrasiveness of coke dust.

Moreover, Link-Belt rolls have been granitized for the handling of certain types of material such as salt, alkali and various other materials that cause in-

crustation, pitting and rusting of ordinary steel or iron.

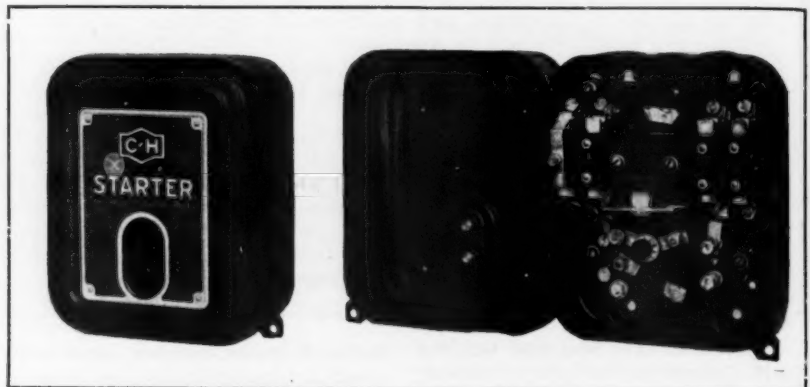
The Idler Rolls are supported in malleable iron brackets having a large bearing surface for supporting them, and they are not dependant upon the use of slots. The brackets are so constructed as to support the ends of two adjacent rolls, thus obtaining perfect alignment of rolls. Roll shafts are supported at both ends close to the rolls, without overhang, thus reducing the bending moment to a minimum.

Rolls are spaced far enough apart to permit convenient removal from the

frame by simply lifting them out without the use of any tools.

Idler rolls are made in various standard lengths, and they are furnished in combinations to suit standard belt widths. The end stands are securely riveted to the "T" iron base, and are spread at the foot to present a rigid support for the Idler.

The Link-Belt Anti-Friction Belt Conveyor Idlers are made at the Ewart plant of the Link-Belt Co., Indianapolis, in a building especially designed for their exclusive manufacture. Write Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill., for further information.



The Smallest Across-the-Line Starter for 5 H. P. A. C. Motors

"No larger than a telephone box" is the way the new Cutler-Hammer 9586 "AAA" Starter is described.

This new Cutler-Hammer product handles motors of 5 h. p. and under, gives push-button control of starting and stopping, provides Thermal Overload Protection and No-Voltage Protection.

The starter is provided with push-buttons in the front cover of the case. The

small size in most cases permits mounting of the starter where the control station would ordinarily be placed and the extra wiring and cost of a push-button station is thus saved. However, one or more push-button stations may be used if desired.

Descriptive literature may be secured by addressing The Cutler-Hammer Mfg. Co., 178 Twelfth Street, Milwaukee, Wis.

New A-C and D-C Solenoids

A new line of solenoids now on the market includes both alternating and direct current types and has been designed especially for uniformity and flexibility. These are made in all voltages and frequencies up to and including 550 volts, and nearly all the different types vary from each other in size only. This line is announced by the General Electric Co., and has been given the designation CR-9503.

Among the advantages claimed by the General Electric Co. are the following:

1. Low cost.
2. Adaptability for either push or pull operation.
3. Unusually long uniform pull. (It is recommended that a lever be used with the solenoid to secure short heavy pulls. This uses the solenoid to its best advantage and permits the use of the smallest possible solenoid.)
4. Low power consumption. The entire magnetic path is laminated.
5. Great pull per pound of solenoid, resulting in space economy.
6. Compact construction.

New Sullivan Drills

The Sullivan Machinery Co. has brought out a new line of rock drills which present various features of interest to users of such equipment. These are described in Mine and Quarry magazine for June.

They include a heavy sinking drill Class T-3; a medium weight sinking rotator, class L-5, an auger drill class H-8, two new sizes of rotators, classes L-7 and L-8.

Further information furnished upon request to Sullivan Machine Co., Chicago, Ill.

H-H Inhalator Combats Monoxide Gas

The H-H Inhalator, a product of the Mine Safety Appliances Company, Pittsburgh, Pa., is a resuscitation device for administering carbogen (95 percent of oxygen and 5 percent of carbon dioxide) to victims of asphyxia from carbon monoxide, gas, smoke, petroleum vapors, collapse, and other causes. Carbogen, by causing full ventilation of the lungs, eliminates poisonous gas from the blood. This instrument was developed by Drs. Yandell Henderson and Howard W. Haggard, of Yale University, and tested and approved by the American Gas Association and the Association of Police and Fire Surgeons.

For further information address Mine Safety Appliances Co., Braddock Avenue and Thomas Boulevard, Pittsburgh, Pa.

Oxygen Breathing Apparatus

The New McCAA-2 Hr. oxygen breathing apparatus, enabling the wearer to work two hours in dangerous quantities of gas, smoke, or where deficiencies in oxygen may exist, has been placed on the market by the Mine Safety Appliances Co., Pittsburgh, Pa. A descriptive folder will be furnished upon request to that company at Braddock Ave. and Thomas Blvd., Pittsburgh, Pa.

Columbus McKinnon Chain Co. Moves to Tonawanda, N. Y.

About the middle of July the executive and general sales offices of the Columbus McKinnon Chain Company, now located in Columbus, Ohio, were removed to Tonawanda, N. Y., at which point their large electric welding plant is located. The Columbus, Ohio, factory will remain as a manufacturing unit. The Columbus McKinnon Chain Company are manufacturers of Dreadnaught Tire Chains, "Inswell" Electric Welded Chain, Hercules Solid Weld Steam Shovel Chain, etc. The executive personnel of the company remains unchanged. The management state that the moving of the executive offices to Tonawanda, N. Y., will enable the company to render more prompt service on the majority of its products.



O-B Trolley Shoe Designed for Heavy Locomotives in Mines

The new trolley shoe for mine work on heavy capacity locomotives just announced by the Ohio Brass Co., Mansfield, Ohio, is a device made of either durable chrome steel or of highly conductive alloy bronze. Its design is such that the axis of the pivot (ball and socket type), is at the middle point of the shoe's line of friction. This is said to result in a perfectly even pressure and complete contact throughout the line of friction at all speeds, which insures slow, uniform wear. Such balance of design also decreases tendency to rotate.

It is also claimed that dust and moisture, so prevalent in mines and so harmful in their effects on other devices of a similar nature, only serve as a lubricant for this shoe rather than as a detriment. In addition, construction of the shoe, according to its makers, is such that arcing which serves to shorten the life of the wire as well as that of the current collector is practically absent. The shoe is equipped underneath with a balance ring designed to give desirable protection to the bottom of the shoe, and it is also mounted on a harp which fits any standard pole bracket.

The Ohio Brass Co. has been two years developing this device and feels that it offers advantages which will be of interest to that part of the mining industry using heavier capacity locomotives.

The Allegheny River Mining Co., Kittanning, Pa., has ordered 100 mine cars from the Loraine Steel Co.

When to Discard Wire Rope

Just when to discard wire rope as worn out is a question on which no definite rules can be applied, states C. D. Meals, rope engineer of the American Cable Co., New York. Too much depends on the local application of the rope and the degree of maintenance attention accorded during its period of service. Metallic area apparently unharmed can not alone be taken as a criterion since two ropes from the same reel, showing the same degree of wear and number of broken wires, may show under test a variation of 25 percent in reserve strength.

There are several reasons for this variation, Mr. Meals says, the principal of which may be that one rope may have been subjected to excessive acceleration stresses which greatly fatigued the steel and causing considerable loss of strength; whereas the other rope may have operated under a more uniform tension and was never overstressed, with a much higher showing in strength as the result. Another factor might be the presence of absence of proper lubrication, which of course, would greatly effect the degree of corrosion—not always visible.

With these qualifications and undeterminable factors in mind the following suggestions for the discarding of wire rope are given in the thought that they may serve users of wire rope to good advantage and do something to lift the degree of safety for workers.

Shaft or skip hoist ropes.—When employed in the work of hoisting elevators or skips the wire rope should be discarded when there are more than three adjacent wires broken in any one strand; when the outer wires have become worn to two-thirds their original diameter, or when marked corrosion appears.

The United States Bureau of Mines in Technical Paper No. 237, advocates that after shaft ropes have been in service for a period of three years, even if idle, they shall not be used unless tested for ultimate breaking strength. Indeed, any rope that has remained idle for some time should be submitted to the test of cutting off and examining the interior wires for possible corrosion and wear. The factor of safety on a deteriorated rope in this class of service should be 4 as minimum.

Derrick ropes.—For boom topping lift, fall or hoisting lines, the ropes should be discarded when there are six or more adjacent wires broken in any one strand or when the outer wires have been worn to one-half their original diameter.

Holding, closing and boom lines on locomotive cranes should be discarded in conformity with the rules given for the "derrick ropes," but when examination of ropes is made, attention should be given that part of the rope passing over equalizing sheaves for the reasons set forth above.

Denver Rock Drill and Gardner-Governor Co. Combine

An \$8,000,000 merger which will bring together the Denver Rock Drill Co. and the Gardner Governor Co., of Quincy, Ill., was announced recently. Together these two large companies employ more than 1,200 men and last year their combined earnings were \$1,425,000. The new concern will be known as the Gardner-Denver Co.

The Denver Rock Drill Co. manufactures principally drills and drilling equipment. The Gardner Co. specializes in pumping machinery, air compressors and oil production tools. It is expected the combination will result in marketing economy.

W. H. Leonard is president of the Denver firm and J. W. Gardner heads the Illinois company.

Ingersoll-Rand Branch Office

In order to provide better sales and service facilities for its customers in northern New Jersey and certain adjacent counties of New York State, Ingersoll-Rand Co. has opened a branch office at 236 High St., Newark, N. J.

Mr. F. K. Armstrong, formerly connected with the company's New York sales branch, has been appointed manager.

General Electric Appointments

Burton L. Delack, assistant manager of the Schenectady works of the General Electric Co. since December 1, 1926, has been appointed acting manager, effective July 1, according to an announcement by Vice President C. C. Chesney. Mr. Delack fills the vacancy caused by the promotion of C. E. Eveleth, elected a vice president June 1 of this year.

Edward A. Wagner, formerly of the Fort Wayne works, but since July, 1926, managing engineer in charge of all distribution transformers, with headquarters in Pittsfield, has been made acting manager of the Pittsfield works, succeeding Mr. Chesney, who has been a vice president in charge of manufacturing since the retirement of F. C. Pratt.

Giuseppe Faccioli, works engineer of the Pittsfield works, has been appointed associate manager and works engineer of the Pittsfield works, Mr. Chesney announced. These appointments are also effective July 1.

Crawler Shovels

Bulletin No. B-10, just published by Link-Belt Company, gives complete up-to-date dimensions and specifications on the line of Link-Belt Crawler Shovels. Copies can be obtained by addressing the Link-Belt Company, 910 South Michigan Avenue, Chicago, Ill.

Shaker Conveyor Handbook

Eickhoff Bros. of Germany, manufacturers of the Eickhoff Conveyor, have issued a booklet entitled "Application of the Shaking Conveyor to Mining," which is being distributed by the Conveyor Sales Co., 299 Broadway, New York City.

This contains descriptions of a number of conveyor mining plans and operations in longwall, room and pillar and modified systems and is well illustrated with sketches and photographs.

European operations are described by Mr. L. Linkowski and American practices by Mr. C. L. Claghorn, both mining engineers who have had a wide experience in conveyor mining. The whole has been edited by Mr. R. A. Walters of the Conveyor Sales Company.

This booklet is dedicated to the American mine operator and is a valuable addition to our literature on conveyor mining.

Ore Milling Machinery and Smelting Equipment

Pamphlet No. 24-G, describing the Akins' Classifier, has just been published by the Colorado Iron Works, Denver, Colo. It contains 16 pages of minute descriptions and drawings, showing the general construction, sizes and types, operating advantages in flotation, concentration, cyanidation, and continuous washing. Colorado Iron Works will be glad to furnish copies of pamphlet 24-G.

Venturafin Unit Heater

The American Blower Company, 6000 Russell Street, Detroit, Mich., has just placed on the market the Venturafin No. 2, a small model circulating heater for use in stores, small factories, garages, offices, corridors, etc. Their catalog describing operation of the Venturafin No. 2 will be sent upon request to the above company.

"Clean Water" Intake Screens

In their June Bulletin B-3 Link-Belt Company, of Chicago, Ill., describes their "clean water" intake screens. This is a 24-page catalog with pictures illustrating the operation of the screens and installations. Copy will be furnished upon request to the company.

Burning Pulverized Fuel

A publication, describing the New Braunfels Station of the Comal Power Company in Texas and its installation of a plant now working successfully in burning pulverized lignite successfully in every-day operation, has been printed by the Combustion Engineering Corporation, 200 Madison Avenue, New York, N. Y., and will be mailed upon request. The boilers comprising the units now in operation are equipped with the Lopulco Storage System for burning pulverized fuel.

Link-Belt Conveyor Data

Of practical use to engineers, plant operators, and all who use belt-conveyor equipment is the 148-page Belt Conveyor Data Book No. 615, just issued by the Link-Belt Company, Chicago, Ill.

A glance through its pages, observing the fund of engineering data therein contained, gives the thought that such a combined catalog and data book could only have been evolved out of many years of research and practical experience in the design, construction, and operation of belt conveyors handling all sorts of material under a variety of operating conditions.

This 148-page book contains new formulae—new data—never published before, and it undoubtedly will prove to be as valuable a hand book on belt conveyors as Carnegie or Kent are in their particular engineering field.

But, aside from being an engineering hand book, it also is a catalog that shows the progress that has been made in the art of conveying materials rapidly, continuously, and economically.

There are many pictures of conveyor installations, as well as of the idlers, return rolls, and other parts, to show their detailed construction.

The most advanced designs of belt-conveyor construction are covered, such as the Link-Belt Anti-Friction Idler, equipped with Timken roller-thrust bearings.

Copies may be obtained from the Link-Belt Company, 910 South Michigan Avenue, Chicago, Ill.

Standards of the Hydraulic Society

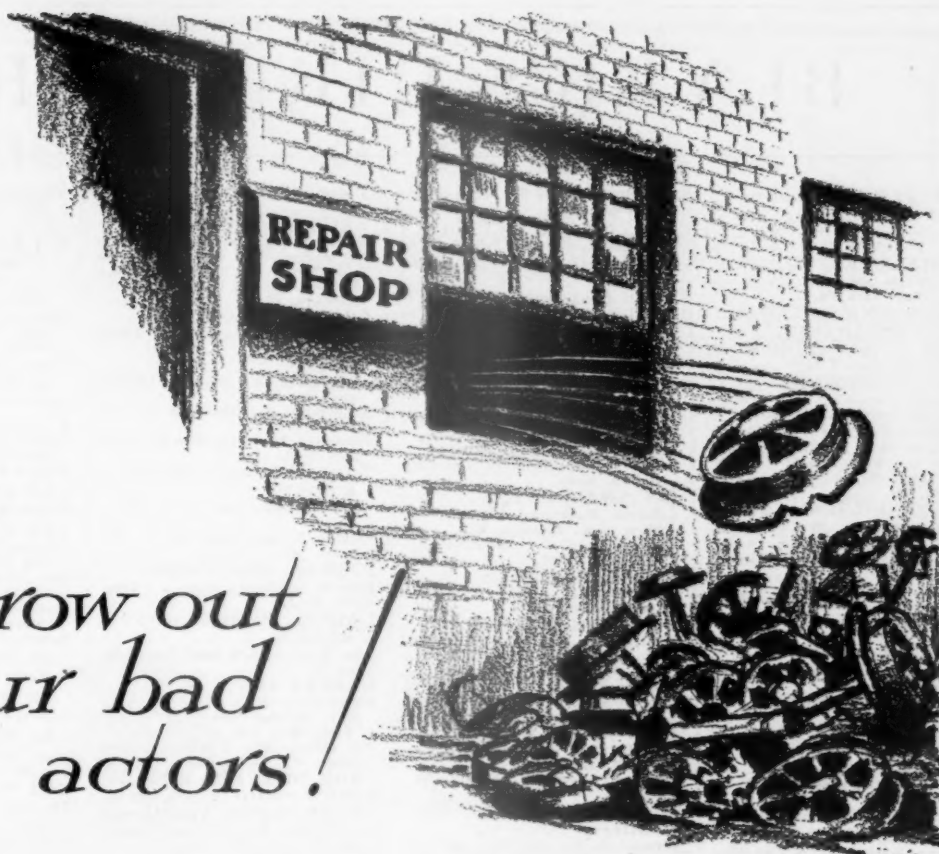
Standards of The Hydraulic Society have just been issued in a fourth edition, comprising 80 pages, 8½ x 11 in. in size.

The new edition is profusely illustrated with charts, tables, drawings, and half tones of pumps and pump parts and an effort has been made to produce a publication that will merit the approbation of the engineering profession.

It contains sections on definitions and values; extracts from pump test codes; a revised pump classification; description of types, parts and definitions pertaining to the several classes of pumps (reciprocating displacement, rotary displacement, centrifugal and deep well); instructions for installing and operating each type; a recommended contract form for use in the pump industry; data, tables, curves and formula, including pipe friction data for both water and oil and a comprehensive list of materials recommended for pumping different liquids.

Copies may be had at the price of 50 cents each upon application to the Secretary, C. H. Rohrbach, 90 West Street, New York.

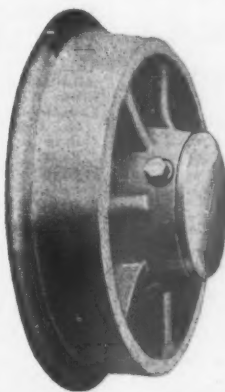
*Throw out
your bad
actors!*



Now is the time to look over your rolling stock. Inspect the wheels on your cars, throw out the bad ones and replace them with new wheels that will stand the gaff of the coming rush season.

It won't pay you to continue using wheels with "flats," worn or grooved treads and sharp flanges. They'll only pound on the track and cost you far more in car repairs and track repairs than the price of new wheels. And the cost of coal spillage and breakage may, in a short while, mean red figures to account for.

Replace those old wheels with "Car



Foundry" Chilled Tread Wheels. They may cost more now but the service they give will make them cheapest in the end. The vast experience of making millions of "Car Foundry" railroad car wheels is back of the men who are making millions of Mine Car Wheels in the same great "Car Foundry" Plants. Exactly the right mixture goes into both types of wheels and exactly the right depth of chill. Equally careful workmanship is assured in the finish. The treads are hard and the structure strong.

Look over your car wheels and replace your old stock with wheels made in the "Car Foundry" Plant nearest your mine.



American Car and Foundry Company

New York St. Louis Chicago Pittsburgh
Berwick, Pa. Bloomsburg, Pa. Huntington, W. Va. Terre Haute, Ind.

CAR FOUNDRY

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BARS, IRON and STEEL
CAR IRONS

BOLTS, NUTS, RIVETS
IRON BODY GATE VALVES
CAR TRUCKS

CHILLED TREAD WHEELS
PINS AND LINKS
FLANGED PIPE

BUYER'S DIRECTORY

ACETYLENE, Dissolved

(Or in Cylinders)

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ACETYLENE GAS

Prest-O-Lite Co., Inc., 30 E. 42d St., New York City.

ACETYLENE GENERATING APPARATUS

Oxweld Acetylene Co., 30 E. 42d St., New York City.

ACID, SULPHURIC

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Ingersoll-Rand Co., New York City.

AIR COMPRESSORS

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Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

AIR HOSE COUPLINGS

Knox Mfg. Co., 811-821 Cherry St., Philadelphia, Pa.

AIR LIFT PUMPING

Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

ANNUNCIATOR WIRES & CABLES

John A. Roebbling's Sons Co., Trenton, N. J.

ANNUNCIATOR WIRES & CABLES, INSULATED

American Steel & Wire Co., Chicago, Ill., and New York.

ARMATURE COILS & LEADS

John A. Roebbling's Sons Co., Trenton, N. J.

ARMORGRIDS

Hendrick Mfg. Co., Carbondale, Pa.

AUTOMATIC CAR CAGES

Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

Roberts & Schaefer Co., Chicago, Ill.

AUTOMATIC CAR DUMPERS

Roberts & Schaefer Co., Chicago, Ill.

AUTOMATIC (Mine Doors, Trucks and Electric Switches)

American Mine Door Co., Canton, Ohio.

AUTOMATIC SWITCH THROWERS

American Mine Door Co., Canton, Ohio.

AUTOMOBILE CABLES

John A. Roebbling's Sons Co., Trenton, N. J.

BALLAST UNLOADER ROPES

John A. Roebbling's Sons Co., Trenton, N. J.

BARS, STEEL

Carnegie Steel Co., Pittsburgh, Pa.

BATTERIES, DRY (for Bells, Buzzers, Signals, Blasting)

National Carbon Co., Inc., 30 East 42nd St., New York City.

BATTERIES (Storage, Gas Welding, Cutting, Dissolved Acetylene)

Prest-O-Lite Co., 30 East 42d St., New York City.

BELL CORD

John A. Roebbling's Sons Co., Trenton, N. J.

BELTING (Conveyor, Elevator, Transmission)

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

BELTING, SILENT CHAIN

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

BINS (Coke and Coal)

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

BITS Carbon (Diamonds) for Core Drill

R. S. Patrick, Sellwood Building, Duluth, Minn.

BITS, Diamond Drilling

R. S. Patrick, Sellwood Building, Duluth, Minn.

BIT SHARPENERS

Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

Ingersoll-Rand Co., 11 Broadway, New York City.

BLACK DIAMONDS

R. S. Patrick, Sellwood Building, Duluth, Minn.

BLASTING POWDER

Atlas Powder Co., Wilmington, Del.

E. I. Du Pont de Nemours & Co., Inc., Wilmington, Del.

Hercules Powder Co., 934 King St., Wilmington, Del.

BLASTING SUPPLIES

Atlas Powder Co., Wilmington, Del.

E. I. Du Pont de Nemours & Co., Inc., Wilmington, Del.

Hercules Powder Co., 934 King St., Wilmington, Del.

BLASTING UNITS (Dry Battery)

National Carbon Co., Inc., 30 East 42nd St., New York City.

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The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Robinson Ventilating Co., Zellen-ople, Pa.

BLOWERS (Tubing)

Robinson Ventilating Co., Zellen-ople, Pa.

BLOWERS (Turbine)

Robinson Ventilating Co., Zellen-ople, Pa.

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BLUE CENTER STEEL WIRE ROPE

John A. Roebbling's Sons Co., Trenton, N. J.

BOND TERMINALS

American Mine Door Co., Canton, Ohio.

BORTZ

R. S. Patrick, Sellwood Building, Duluth, Minn.

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American Rheolaveur Corporation, Wilkes-Barre, Pa.

Vulcan Iron Works, Wilkes-Barre, Pa.

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The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

BREAST MACHINES

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

BRIQUETTING MACHINERY

Vulcan Iron Works, Wilkes-Barre, Pa.

BRUSHES (Carbon, Graphite and Metal Graphite for Electric Motors, Generators and Converters)

National Carbon Co., Inc., Cleve-

land, Ohio and San Francisco, Calif.

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Hendrick Mfg. Co., Carbondale, Pa.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CABLE GREASE

Keystone Lubricating Co., Philadelphia, Pa.

CABLES

American Steel & Wire Co., Chicago and New York.

A. Leschen & Sons Rope Co., St. Louis, Mo.

Roebbling's Sons Co., John A., Trenton, N. J.

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Leschen & Sons Rope Co., A., St. Louis, Mo.

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John A. Roebbling's Sons Co., Trenton, N. J.

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S. Flory Mfg. Co., Bangor, Pa.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

CAGE DUMPERS, ROTARY

Roberts & Schaefer Co., Chicago, Ill.

CAGES (Safety Appliances)

Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

CAGE STOPS & LOCKS

Mining Safety Device Co., Bowers-ton, Ohio.

Roberts & Schaefer Co., Chicago, Ill.

CAGERS, AUTOMATIC

Mining Safety Device Co., Bowers-ton, Ohio.

CAGERS, AUTOMATIC & MANUAL

Roberts & Schaefer Co., Chicago, Ill.

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Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

Vulcan Iron Works, Wilkes-Barre, Pa.

CAGES (Self-dumping)

Roberts & Schaefer Co., Chicago, Ill.

CALCINERS

Vulcan Iron Works, Wilkes-Barre, Pa.

CALCIUM CARBIDE

Union Carbide Sales Co., 30 East 42nd St., New York City.

CARBON AND BORTZ

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R. S. Patrick, Sellwood Building, Duluth, Minn.

CARBON BURNING APPARATUS

Oxweld Acetylene Co., 30 E. 42d St., New York City.

CARBON ELECTRODES (for Electric Furnaces and Electrolytic Work)

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CARBONS (for Arc Lamps, Blue Printing, Photographic)

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CARBON SPECIALTIES (Circuit Breaker Contacts, Packing Rings, Filter Plates, Tubes, etc.)

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CAR DUMPERS (Rotary)

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Chicago, Ill.

CAR FEEDERS

Roberts & Schaefer Co., Chicago, Ill.

CAR HAULS

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Chicago, Ill.

CAR PULLERS

S. Flory Mfg. Co., Bangor, Pa.

CAR RETARDERS

Roberts & Schaefer Co., Chicago, Ill.

CAR STOPS, AUTOMATIC & MANUAL

Roberts & Schaefer Co., Chicago, Ill.

CAR WIRE & CABLES

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John A. Roebbling's Sons Co., Trenton, N. J.

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The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre, Pa.

CASTINGS, OPEN HEARTH STEEL

Vulcan Iron Works, Wilkes-Barre, Pa.

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Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

CHAINS, AUTOMOBILE ENGINE

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

CHAINS, COAL CUTTING

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CHAINS, DRIVE

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CHAINS, FRONT END

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

CHAINS, OILING

Morse Chain Co., Ithaca, N. Y.

CHAINS POWER TRANSMISSION

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

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IN A FIELD that is developing and has developed as rapidly as that of oxy-acetylene welding and cutting, it is impossible for even the most alert welder or engineer to keep abreast of new developments.

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It is their job to know what is going on and to be ready with advice or instruction whenever a Linde customer wants help.

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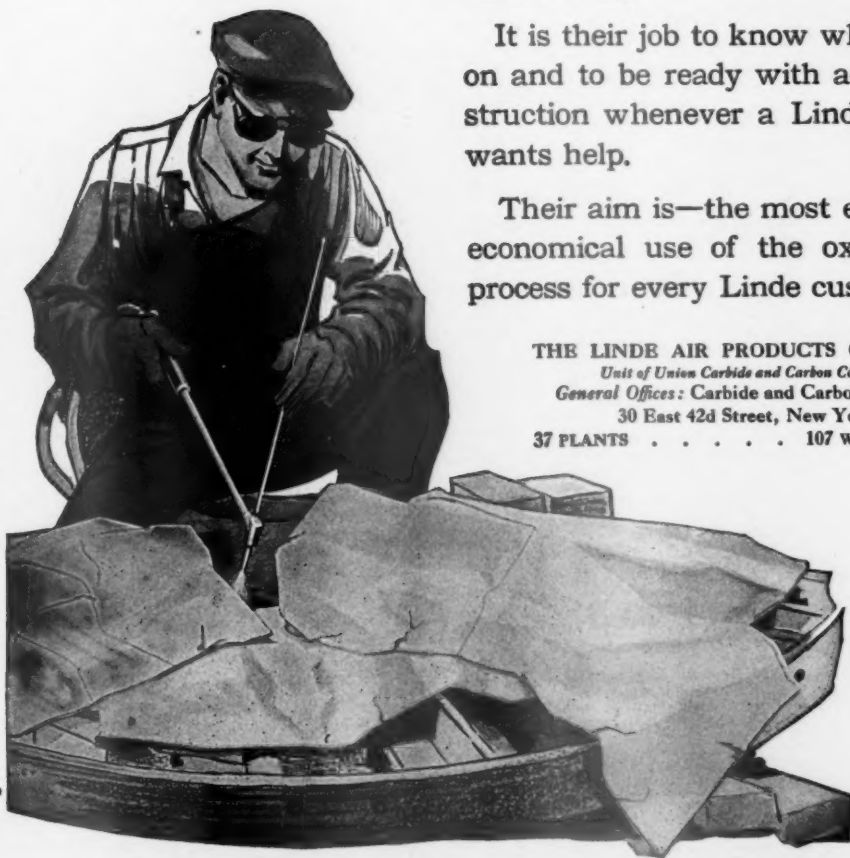
THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Company

General Offices: Carbide and Carbon Building

30 East 42d Street, New York

37 PLANTS 107 WAREHOUSES



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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Morse Chain Co., Ithaca, N. Y.

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Knox Mfg. Co., Philadelphia, Pa.

CLAMPS (Trolley)

Ohio Brass Co., Mansfield, Ohio.

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CLIPS, WIRE ROPE

American Steel & Wire Co., Chicago, Ill., and New York.

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CLUTCHES

Connellville Mfg. & Mine Supply Co., Connellville, Pa.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

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American Rheolaveur Corporation, Wilkes-Barre, Pa.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Chicago, Ill.

COAL COMPANIES

General Coal Company, Land Title Bldg., Philadelphia, Pa.

Lehigh Coal & Navigation Co., Philadelphia, Pa.

Thorne, Neale & Co., Philadelphia, Pa.

COAL CRUSHERS

Connellville Mfg. & Mine Supply Co., Connellville, Pa.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

COAL CRUSHERS & ROLLS

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Vulcan Iron Works, Wilkes-Barre, Pa.

COAL CUTTERS

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Howells Mining Drill Co., Plymouth, Pa.

Ingersoll-Rand Co., 11 Broadway, New York City.

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Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

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Conveyor Sales Co., Inc., 299 Broadway, New York City.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Chicago, Ill.

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Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Chicago, Ill.

COOLERS, Man

Robinson Ventilating Co., Zellenople, Pa.

COOLERS, ROTARY

Vulcan Iron Works, Wilkes-Barre, Pa.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Howells Mining Drill Co., Plymouth, Pa.

Ingersoll-Rand Co., 11 Broadway, New York City.

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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

COAL MINING PLANTS

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.

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Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Ingersoll-Rand Co., 11 Broadway, New York City.

COMPRESSORS, MINE CAR

Ingersoll-Rand Co., 11 Broadway, New York City.

CONCENTRATORS (Table)

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CONCRETE REINFORCEMENT

American Steel & Wire Co., Chicago, Ill., and New York.

CONDENSERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Ingersoll-Rand Co., 11 Broadway, New York City.

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Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

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Conveyor Sales Co., Inc., 299 Broadway, New York City.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Chicago, Ill.

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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CONVEYORS, BELT

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CONVEYORS, CHAIN FLIGHT

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

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Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

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Conveyor Sales Co., Inc., 299 Broadway, New York City.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CONVEYORS, PAN OR APRON

Conveyor Sales Co., Inc., 299 Broadway, New York City.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CONVEYORS, SCREW

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

COOLERS, Man

Robinson Ventilating Co., Zellenople, Pa.

COOLERS, ROTARY

Vulcan Iron Works, Wilkes-Barre, Pa.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Howells Mining Drill Co., Plymouth, Pa.

Ingersoll-Rand Co., 11 Broadway, New York City.

COPPER WIRE & STRAND

(Bare)

American Steel & Wire Co., Chicago, Ill., and New York.

John A. Roebeling's Sons Co., Trenton, N. J.

CORE DRILLS, Carbon (Diamonds) for

R. S. Patrick, Sellwood Building, Duluth, Minn.

CORE DRILLING

H. R. Ameling Prospecting Co., Rolla, Mo.

Hoffman Bros., Punxsutawney, Pa.

Mott Core Drilling Co., Huntington, W. Va.

COUPLINGS, FLEXIBLE

Fawcett Machine Co., Pittsburgh, Pa.

COUPLINGS, ROCK DRILL

Knox Mfg. Co., Philadelphia, Pa.

CROSSINGS AND CROSSEOVERS

Central Frog & Switch Co., Cincinnati, Ohio.

CROSSOVERS

Sweet's Steel Co., Williamsport, Pa.

CRUSHERS

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Allis-Chalmers Mfg. Co., Milwaukee, Wis.

CRUSHERS, COAL

Connellville Mfg. & Mine Supply Co., Connellville, Pa.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CRUSHERS, SINGLE & DOUBLE ROLL

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CRUSHING PLANTS, COKE

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CRUSHING PLANTS, COKE

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CUP GREASE

Keystone Lubricating Co., Philadelphia, Pa.

CUTTING APPARATUS, Oxy-Acetylene, Oxy-Hydrogen

Oxweld Acetylene Co., 30 E. 12d St., New York City.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

DECARBONIZING APPARATUS

Oxweld Acetylene Co., 30 E. 42d St., New York City.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

DESIGNERS OF PLANTS

American Rheolaveur Corporation, Wilkes-Barre, Pa.

Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

Roberts & Schaefer Co., Chicago, Ill.

DIAMOND CORE DRILL CONTRACTING

H. R. Ameling Prospecting Co., Rolla, Mo.

Hoffman Bros., Punxsutawney, Pa.

Mott Core Drilling Co., Huntington, W. Va.

Sullivan Machinery Co., Chicago, Ill.

DIAMOND DRILLING CARBON

R. S. Patrick, Sellwood Building, Duluth, Minn.

DIAMONDS, BLACK (See Carbon and Bortz)

R. S. Patrick, Sellwood Building, Duluth, Minn.

DIAMONDS, INDUSTRIAL

R. S. Patrick, Sellwood Building, Duluth, Minn.

DIGGERS & PICKS, Pneumatic

Ingersoll-Rand Co., 11 Broadway, New York City.

DITCHING MACHINES

Keystone Churn Drill Co., Beaver Falls, Pa.

DOORS, AUTOMATIC MINE

American Mine Door Co., Canton, Ohio.

DOWNIE DEEP WELL PUMPS

Keystone Churn Drill Co., Beaver Falls, Pa.

DRIFTERS, DRILL

Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLING CONTRACTORS

Pennsylvania Drilling Co., Pittsburgh, Pa.

DRILLING, DIAMONDS FOR

R. S. Patrick, Sellwood Building, Duluth, Minn.

DRILLS, AIR AND STEAM

Howells Mining Drill Co., Plymouth, Pa.

Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLS (Blast Hole)

Howells Mining Drill Co., Plymouth, Pa.

Ingersoll-Rand Co., 11 Broadway, New York City.

Keystone Churn Drill Co., Beaver Falls, Pa.

DRILL BITS, Carbon (Diamonds) for

R. S. Patrick, Sellwood Building, Duluth, Minn.

DRILL, CARBON (Diamonds) for

R. S. Patrick, Sellwood Building, Duluth, Minn.

DRILL COLUMNS & MOUNTINGS

Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLER'S DIAMONDS

R. S. Patrick, Sellwood Building, Duluth, Minn.

DRILLS, CORE

H. R. Ameling Prospecting Co., Rolla, Mo.

Hoffman Bros., Punxsutawney, Pa.

Ingersoll-Rand Co., 11 Broadway, New York City.

Keystone Churn Drill Co., Beaver Falls, Pa.

Mott Core Drilling Co., Huntington, W. Va.

DRILLS, DIAMOND GASOLINE OUTFITS

Mott Core Drilling Co., Huntington, W. Va.

DRILLS, ELECTRIC

General Electric Co., Schenectady, N. Y.

Howells Mining Drill Co., Plymouth, Pa.

Ingersoll-Rand Co., 11 Broadway, New York City.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

DRILLS, HAMMER

Ingersoll-Rand Co., 11 Broadway, New York City.

Sullivan Machinery Co., 122 S. Mich. Ave., Chicago, Ill.

DRILLS (Hand Operated)

Howells Mining Drill Co., Plymouth, Pa.

Ohio Brass Co., Mansfield, Ohio.

DRILLS, MINERAL PROSPECTING

Keystone Churn Drill Co., Beaver Falls, Pa.

Mott Core Drilling Co., Huntington, W. Va.

Sullivan Machinery Co., Chicago, Ill.

DRILLS, PNEUMATIC

Howells Mining Drill Co., Plymouth, Pa.



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Hidden away in vital parts of mine car equipment—guarding permanently against friction and wear—saving power—minimizing maintenance—adding many extra years of better service life—Hyatt Roller Bearings have made their presence known only through the economies they effect.

Manufacturers, proud of Hyatt performance in their products,

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HYATT ROLLER BEARING COMPANY

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Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

DRYERS, ROTARY

Vulcan Iron Works, Wilkes-Barre, Pa.

DUMP CARS

Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

DUMPS, ROTARY

Roberts & Schaefer Co., Chicago, Ill.

DYNAMITE

Atlas Powder Co., Wilmington, Del.
E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

DYNAMOS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

ELECTRICAL APPARATUS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

ELECTRICAL CABLES & WIRES

American Steel & Wire Co., Chicago, Ill., and New York.
Roebling's Sons Co., John A., Trenton, N. J.

ELECTRIC DRILLS

Howells Mining Drill Co., Plymouth, Pa.

ELECTRIC HOISTING MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

ELECTRIC LOCOMOTIVES

General Electric Co., Schenectady, N. Y.

Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

Ohio Brass Co., Mansfield, Ohio.

ELECTRIC LOCOMOTIVE CABLES

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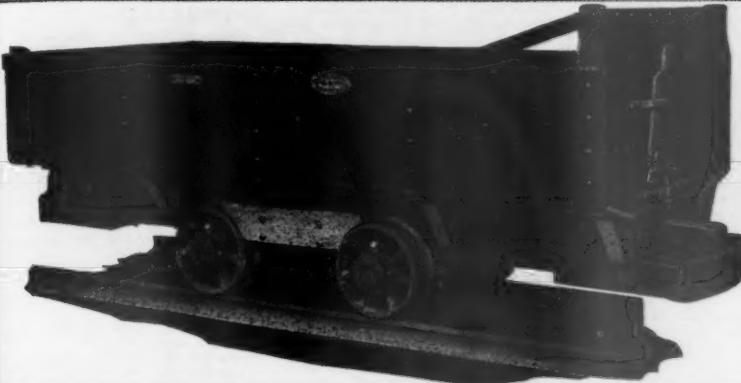
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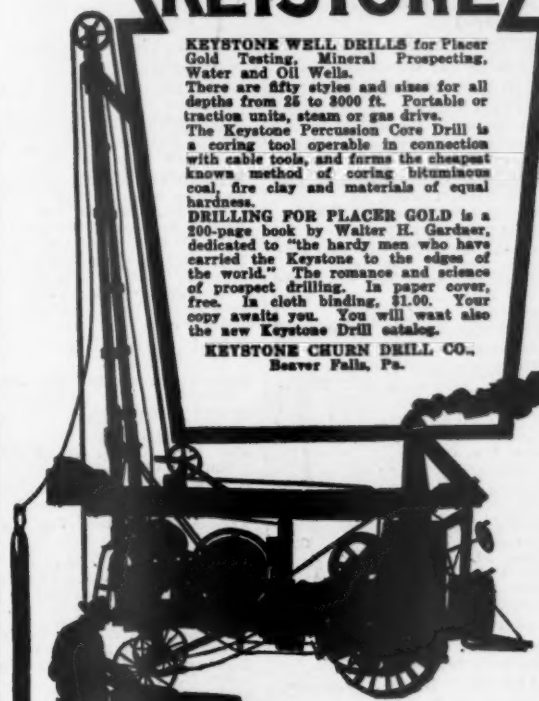
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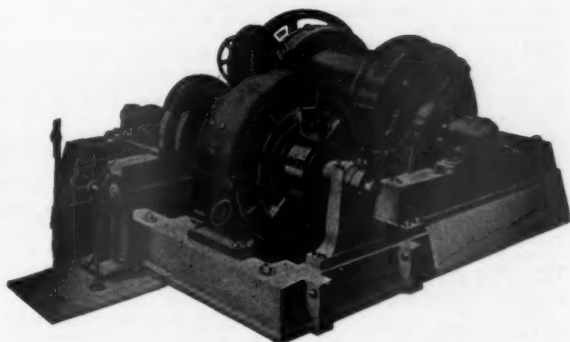
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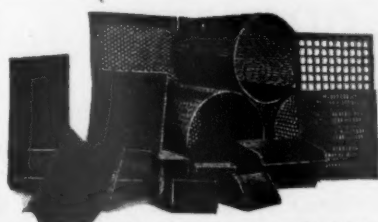
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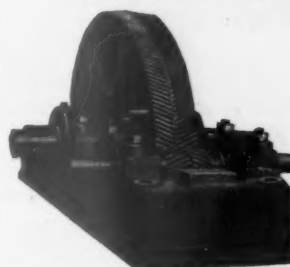
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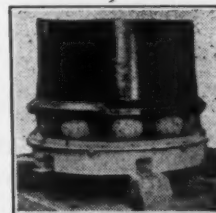
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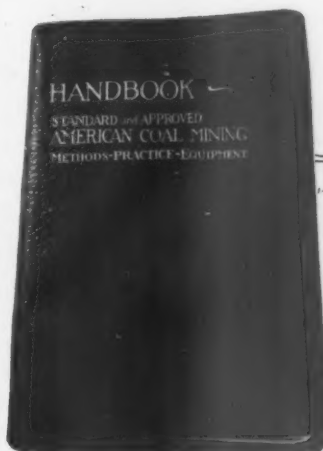
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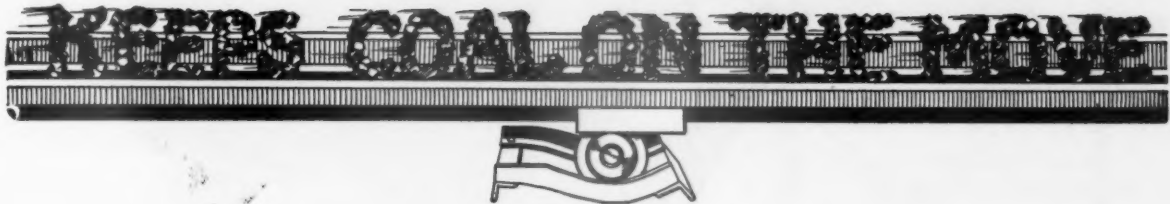
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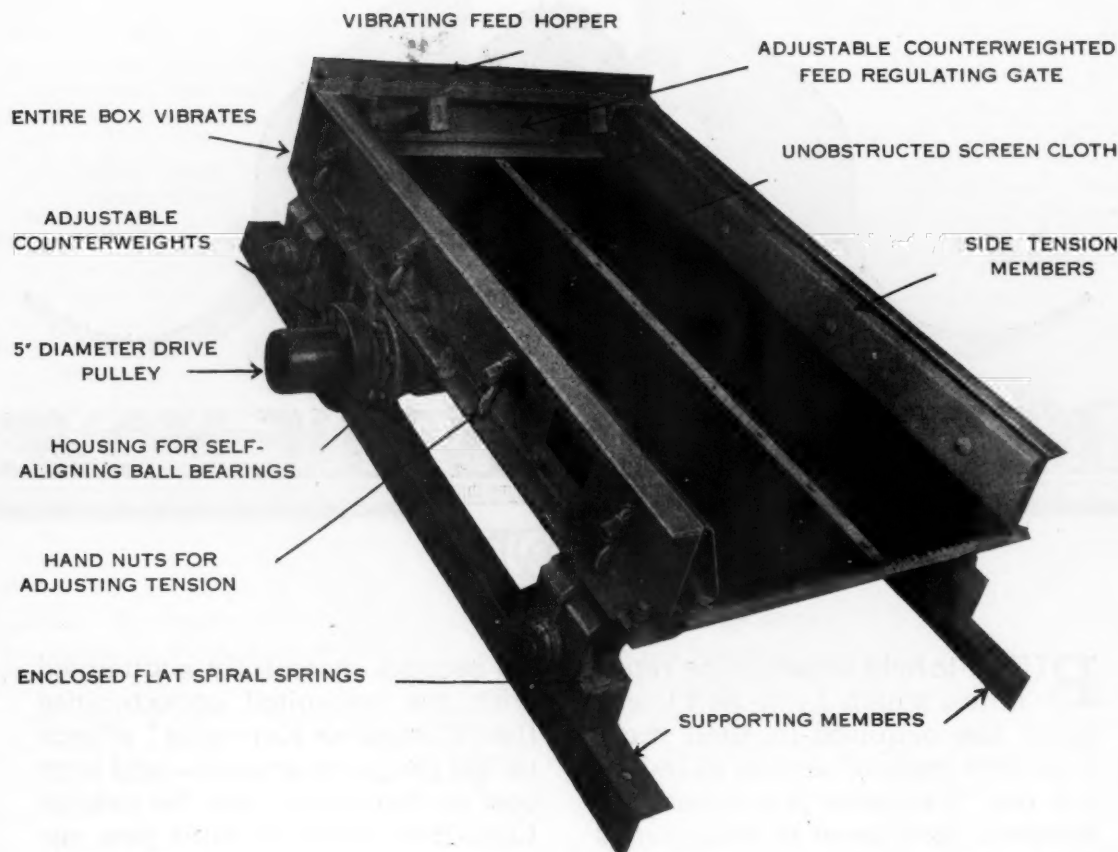
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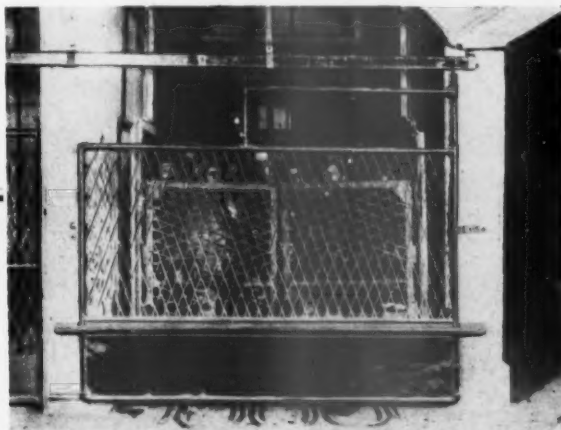
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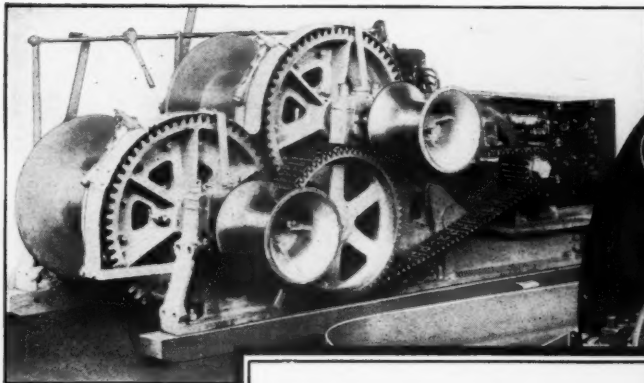
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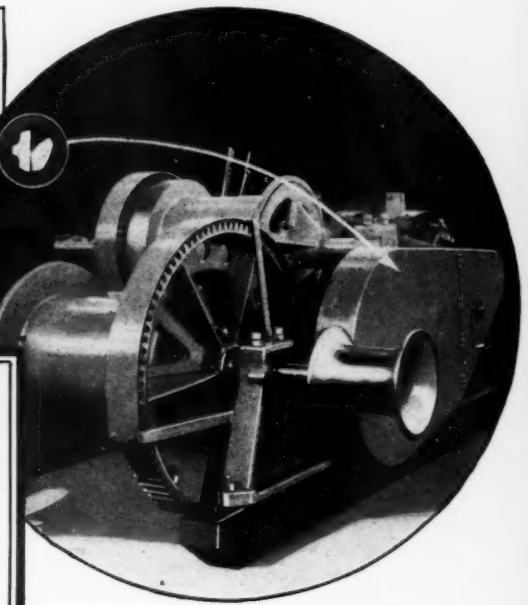
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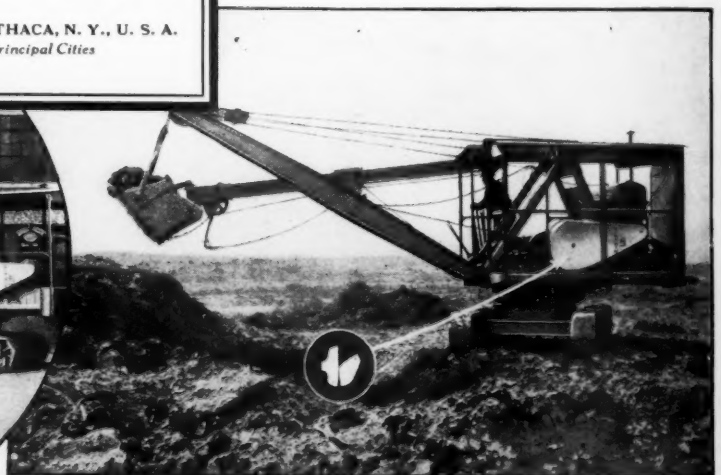
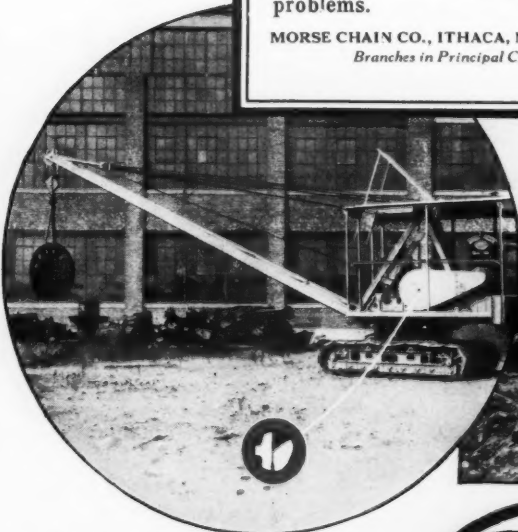


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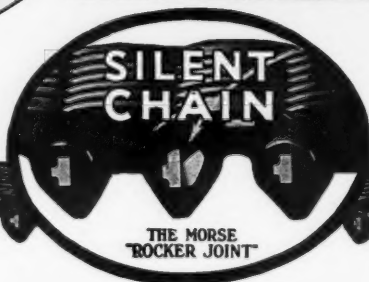
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